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ADVANCED MATERIALS

German Institute Presents Metal-Glass Composites

92MI0428 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 25 Mar 92 p 5

[Text] The Federal Applied Physics Institute [PTB] is exhibiting a new composite material at the Hannover fair. This material is composed of aluminum and amorphous, iron-nickel-cobalt-based soft magnetic alloys known as metallic glass, and was developed at the PTB for the construction of high-grade magnetic screens for magnetic fields in the 0 Hz to several hundred kHz frequency range. The new material differs from screening materials used in the past in that its magnetic properties are not altered even by machining, e.g., turning and milling.

Germany: Chemical Companies Develop New Materials

92WS0416A Duesseldorf WIRTSCHAFTSWOCHE in German 7 Feb 92 pp 46-50

[Article by Rolf Froboese: "Chemical Industry: Acid Test in Future Markets: Rheumatism in the Bones"; first paragraph is WIRTSCHAFTSWOCHE introduction]

[Text] The slumping industry hopes to regain its dynamics through a deliberate push into new material technologies.

The fat years have apparently clouded perceptions of reality. Spoiled by an economic upswing that provided the chemical industry with lavish growth in sales and earnings for nearly a decade, industry meteorologists interpreted the gathering storm clouds as nothing more than a temporary cold front. However, the extent of the actual onset of foul weather is as painful to the companies as rheumatism in the bones: Chemical companies around the world—from Bayer AG, Hoechst AG, BASF AG, and Degussa AG to Great Britain's Multi ICI, Switzerland's Ciba-Geigy AG or the U.S. giants DuPont Co., Dow Chemical Corp., and Union Carbide—are seriously concerned about drastic slumps in profits of between 30 and 50 percent in 1990.

Hermann J. Strenger, chairman of the board of Bayer AG and president of the Association of the Chemical Industry (VCI), intends to dress more warmly in view of the ongoing turbulence: "We are expecting harsh headwinds for 1992 as well." New materials will alter the future market structures of the chemical industry more than any other discipline. This is the conclusion reached by London's IAL Consultants Ltd., which recently emphasized the growing importance of technical thermoplasts in a comprehensive study. The Britons predict impressive growth rates of 12 percent a year for modern, high-tech polymers for industry, such as polyphenylene sulfide (PPS), polysulfone (PSU), polyethersulfone

(PES), and polyetherketone (PEK), but also liquid crystal polymers (LCP's) and polyamides.

For other high-tech materials, future prospects are no less rosy. According to a study by Basel's Prognos AG, the world market for new materials will grow from around 50 billion German marks [DM] at present to DM120 billion in the year 2000.

Among the most eager buyers of heavy-duty composite materials is the international aerospace industry in particular. According to figures from Frost & Sullivan Ltd., this demand will add a market volume in Europe alone of more than \$1 billion by 1994. After that, according to the U.S. market researchers, demand by the automobile industry for these high-tech materials will also increase.

In the quest for materials with hitherto unknown properties, a Hoechst AG assault detachment has recently stumbled on a vein of gold: functional materials. "Our researchers face a completely new challenge here," explains Harald Cherdron, the head of research at Hoechst AG, "because suddenly there is a demand for materials with chemical and physical properties that used to be quite unusual in polymers."

The researchers are focusing especially on electroconductive synthetics, but also on materials that undergo very rapid physical changes when exposed to light. Among the most promising development projects are polymers with nonlinear optical properties. These change their optical properties with the intensity of the irradiated light, and can thus be used as switches or frequency multipliers in optoelectronic systems.

Similarly lucrative, future business is expected from special fluorine polymers. Using new chemical and physical tricks, R&D experts are trying to wring improved optical properties out of this synthetic material. Hoechst researcher Friedrich Herold, who is responsible for new polymers, is already completely captivated by an emerging billion-mark business, especially in the field of telecommunication. "Because of their high degree of flexibility, polymer optical waveguides stand head and shoulders above glass fibers," the Hoechst researcher says. However, the attenuation of information-containing light flashes in synthetic conductors is many times higher than in glass fiber cables.

In view of products such as these, the emphasis in the business fields of the chemical industry will clearly shift—as will the competitive situation. In particular, the Japanese are now hoping to make a strong showing in the dynamically growing specialized markets. "New Chemistry," a program for the future with its focus on the 21st century, betrays the journey's destination. Without exception, it covers those market segments in the high-chem sector in which double-digit growth rates are expected. Research directors at the participating Japanese chemical companies—Takeda, Mitsubishi Chemical, Asahi Chemical, Sumitomo Chemical, and Toray Industries—have targeted the four sectors of aerospace, biotechnology, pharmaceuticals, and electronics.

While Japan's petrochemical companies are already of concern to the Europeans and Americans as bitter competitors in the development of high-tech synthetics, which experts call super-engineering plastics, the ceramics industry in the Far Eastern island empire has also raised a furor concerning new composite specialties. The French chemical company Rhone-Poulenc has already suffered considerably from these attacks, due to Asian dumping prices for high-tech polymers and ceramics. The result: A catastrophic slump in profits of 53 percent during fiscal year 1990. Ulf Dressler, the managing director of the Rhone-Poulenc subsidiary Ceramiques et Composites Deutschland GmbH in Lauenbach, has in the meantime abandoned all illusions: "Companies such as Kyocera," the manager openly admits, "are way ahead of us."

Despite such words of reverence for the Japanese, defeatism has not yet taken hold of the German chemical industry. Instead, Japanese innovative hits such as so-called memory polymers (synthetics with shape memory) or knives made out of composite ceramics are played down as cheap showmanship. "What the customer really expects from us," BASF board chairman Juergen Strube says, explaining his company's strategy, "is not finished products, but rather complete problem solutions."

Still, some companies, such as Hoechst AG, are already reacting to the Japanese challenge. In order to operate as close to the customer as possible, the company, in a hastily formulated strategy plan, has moved part of its development work in the field of LCDs [liquid crystal displays] to the company's own Advanced Material Laboratory in Kawagoe, in Greater Tokyo. The Japanese enjoy a worldwide technological lead in LCD applications.

Hoechst is considered one of the companies that has dashed the furthest ahead thus far in the move into new markets. All the stops are being pulled out at the central research division in Frankfurt as well. The latest development work on synthesizing ceramic fibers from so-called polysilazanes is targeted at the needs of a demanding clientele. The highlight: The silicon-organic starting compound can be spun into fine threads which are transformed into extremely thin ceramic fibers in a subsequent pyrolysis process. They are characterized by surprisingly high tensile strengths that hold up even at hellish application temperatures of more than 1,200°.

Another group of Hoechst researchers, using chemical vapor deposition (CVD) has succeeded for the first time in producing flexible superconducting filaments. "We are still very much at square one in this technology," admits Hans Sixl, the head of Hoechst's Applied Physics Division, "but we figure that we have a good chance for the future." The international run on ceramic high-temperature superconductors is enormous. Prognoses by Japanese and American market researchers for the year 2010 are in the range of DM3 billion—and this for the chemicals trade alone.

Given the crumbling traditional markets, more and more midsize companies are joining the industry giants in throwing out the high-chem rescue anchor. One of the most successful leaders in this sector is Zipperling Kessler & Co. in Ahrensburg. In conjunction with two American suppliers, the Germans have succeeded in producing the world's first electroconductive synthetic material to be offered on the market.

As a result of the intensifying pressure from international competition, cooperative research arrangements between various companies are a proven means for lowering costs and concentrating strengths. In the "ultrathin polymer films" project, for example, BASF, Bayer, Hoechst, Siemens, and various Max Planck and university institutes are now in the same boat. In another project in the area of high-tech ceramics, Bayer, Daimler-Benz, Hoechst, MTU, and the Max Planck Institute for Metal Research in Stuttgart have joined forces.

Tom Sommerlatte, the European head of the international technology consulting firm Arthur D. Little, Inc., concludes from these first cooperative arrangements that the structures of the chemical industry will undergo serious changes in the coming years. Sommerlatte's scenario for the chemical industry in the year 2010, which should have doubled its sales to around DM3 trillion by then, includes only three categories:

- Around one dozen megacompanies, which will account for 40 percent of the world market;
- Chemical specialties companies, with annual sales of DM5 billion to DM6 billion, making up around 20 percent of the world market;
- Supply companies, which enter into strategic alliances with the megacompanies, and
- Several dozen production companies for consumer and industrial products, with a worldwide market share of around 30 percent.

Anyone who wants to play a future role in the international arena as one of the strong dozen must set the course right now. Professor Heinz Harnish, the research chief at Hoechst AG, sees several stumblingblocks for Germany's chemical industry on the road to new technologies and markets, in the form of protracted and nerve-wracking licensing processes. The high-tech trailblazer complains: "It is nothing short of intolerable that innovation in this country continues to be strangled."

AEROSPACE

German Aerospace, Fokker To Work on Joint Projects

92MI0327 Bonn DIE WELT in German 5 Mar 92 p 16

[Text] In the future, Dutch aircraft manufacturers Fokker NV of Amsterdam want to work with Daimler Benz subsidiary of German Aerospace (DASA) on "specific projects" relating to the construction of the short- and medium-haul F-70 and F-100 jets, a Fokker

spokesman told DIE WELT yesterday. Negotiations were already under way and were expected to be completed in a "few months' time." According to the spokesman, "additional options" were also being discussed during the negotiations, although they had not yet taken concrete form. Fokker does not, however, rule out a merger with DASA, which would create one of the biggest manufacturers of short- and medium-haul jets with seating capacities ranging from 70 to 130 passengers.

Furthermore, Fokker has announced that, for the first time since 1986, a dividend amounting to 0.75 florins per share, will be paid out for 1991. In 1986, the dividend amounted to 1.75 florins.

Italian Space Agency President Reports on 1990-94 Programs

92MI0336 Turin MEDIA DUEMILA in Italian Feb 92 pp 60-61

[Article by Luciano Guerriero, president of the Italian Space Agency: "Italy in the Space Panorama"]

[Text] Three important events characterized Italian space activity in 1991: The success of Italsat, the approval by CIPE [Interministerial Committee for Economic Planning] of the new 1990-94 National Space Plan, and the new prospects for international collaboration that emerged from the ESA [European Space Agency] ministerial conference in Munich.

Italsat, which was placed into orbit in January 1991 and became fully operational in the following months, can be considered a symbol of the evolution that took place in the Italian aerospace industry over 1980-90. The ongoing development of Italsat 2 and the accords with STET [Turin Telephone Finance Company], which will be responsible for the launch of the satellite, demonstrate how the Italian Space Agency's (ASI) R&D programs have led to new solutions that are at the forefront at the international level and also of importance to national operators.

Following the launch of Italsat in 1991, and those planned for 1992 (Tethered, IRIS [Italian Research Interim Stage], Lageos 2) and for 1993 (SAX, SAR-X [Synthetic Aperture Radar], and Italsat 2), Italy will have reached its full development potential and will be on a par with the most important space players in Europe and throughout the world.

The 1990-94 National Space Plan approved by CIPE in July 1991, is the ASI's first multiyear strategic program and projects Italian activity into the new phase of full development. The program is a good balance between ESA activities and those managed directly by the ASI. For both, however, it represents a clear jump in quality.

Europe is developing its own laboratories in space and an independent access for its astronauts with the ESA's Columbus, Ariane 5, Hermes, and DRS [Data Relay

Satellite] programs. In these programs, Italy holds a coleading position in the development of this major orbiting infrastructure.

Several new programs will be launched at the national level. Two programs to be carried out in collaboration with NASA will make a fundamental contribution to the success of important missions. The logistics module of the Freedom space station will be a fundamental element of the manned system in its first years of operation, as will the SAR telecommunications and observation system (Titan radar mapper) for the Cassini interplanetary mission that is designed to explore Saturn and its satellites at close range.

At the national level the new plan also provides for the development of an independent launching capability in the small satellite sector. This will consolidate the original project presented some time ago by Professor Luigi Broglio, who played an important role in the initial development of the Italian space program. The decision also concerns national industries, with interesting prospects also for launches of small scientific and applications satellites.

A clear sign of Italy's new role in the European space panorama emerged during the ministerial meeting of the ESA Council in Munich. At the meeting, Minister Ruberti and Under Secretary Saporito made a very important contribution in solving a difficult situation made more complex by a new world order: The unification of Germany; the birth of new countries from what had been the Soviet Union; and the end of East-West space race, which certainly had played a more than secondary role in determining the space-related decisions made by the United States and Europe.

The solution proposed by Italy, and adopted by the ESA ministers, establishes a better relationship between politicians and the executive structure, thereby introducing the flexibility needed to carry out these ambitious programs. This will also favor an increasingly broader cooperation at international level. In so doing, the highly qualified expertise that the Soviet Union had acquired in the space structure can be incorporated into the overall system.

All this confirms the timely decisions made by our country, which has long recognized the strategic role of space, not only as a means of promoting technology and science and as an ideal motivation for new generations, but also as an important element of its foreign policy.

1990-1994 Plan

ESA Funding	
Technical Facilities	3.8 percent
Scientific Satellites	10 percent
Telecommunications	21.4 percent
Earth Observation	3.2 percent
Space Transport	36.3 percent

Orbiting Infrastructures	25.3 percent
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1990-1994 Plan

Proposed Undertakings	
Operations	8.6 percent
Bases/Operations	5.5 percent
Basic Research	5.5 percent
Technical Facilities	6.3 percent
Earth Observation	7.6 percent
Scientific Satellites	13.4 percent
Telecommunications	15.5 percent
Space Transport	22.1 percent
Orbiting Infrastructures	15.5 percent

1990-1994 Plan

National Funding	
Basic Research	15 percent
Technical Facilities	12.1 percent
Scientific Satellites	23 percent
Telecommunications	13.5 percent
Earth Observation	16.7 percent
Space Transport	11.6 percent
Orbiting Infrastructure	8.1 percent

1990-1994 Plan

Proposed and Future Undertakings	
Operations	8 percent
Bases/Operations	4.2 percent
Basic Research	4.2 percent
Technical Facilities	5.1 percent
Scientific Satellites	12.6 percent
Telecommunications	16.7 percent
Space Transport	18.9 percent
Orbiting Infrastructures	18 percent
Earth Observation	12.3 percent

Italian, French, German Microgravity Centers Sign Accord

92MI0360 Rome AIR PRESS in Italian 11 Mar 92
p 509

[Text] On 4 March, a scientific-technical agreement was signed between the Italian MARS [Microgravity Advanced Research and Support] center, a consortium established by Alenia and the University of Naples, and its counterparts CADMOS [Support Center for the Development of Microgravity and Space Orientations] of Toulouse and MUCS [Microgravity User Support Center] of Cologne, which fall under the national space agencies of France and Germany respectively. Under the

agreement the three centers will cooperate in space programs involving microgravity tests: On the future orbiting platforms, American shuttles, the future Freedom space station, and, in particular, in its European component, the scientific laboratory of the Columbus system. The three centers will identify the uses to be made of the laboratory and the experiments to be carried aboard, and will also determine the most interesting industrial and commercial prospects of the methodologies and products developed. MARS is a project by the late Professor Luigi Napolitano, who died last year. He was the foremost promoter of Italian activities in the area of microgravity. Directed by Professor Francesco Lancetti, MARS now has a staff of 30, all highly qualified and already boasts many joint projects, also involving the Canadian and Japanese space agencies.

German Space Cooperation With CIS Discussed

92MI0379 Bonn DIE WELT in German 19 Mar 92
p 21

[Article by Anatol Johansen: "Kohl Talks to Flade—Riesenhuber Sees Prospects for Improving Space Collaboration with CIS"]

[Text] Around noon today, according to the flight schedule, the Soyuz TM-14 space vehicle carrying cosmonauts Alexander Viktorenko, Alexander Kaleri, and German Luftwaffe Colonel Klaus Dietrich Glade, will dock at the Russian space station Mir at an altitude of 400 kilometers. The three cosmonauts will then join Sergei Krikalov and Alexander Volkov who have been manning the station for some time—Krikalov since last May, and Volkov since October. At about 1600, Federal Chancellor Helmut Kohl is expected to send them his greetings from Bonn.

Following last Tuesday's successful launch in Baikonur, Federal Research Minister Heinz Riesenhuber has high hopes for the space mission: At the very least he expects an increase in space collaboration between the Commonwealth of Independent States (CIS) and Germany, and possibly western Europe in general, if the Flade project runs smoothly and brings successes.

This would make it quite conceivable for Germany to avoid making part of the heavy investment needed for space missions as the facilities can be purchased comparatively inexpensively from the Russians instead. This would in turn contribute to the recovery of the CIS economy and generate revenue from its space infrastructure. In this connection, Riesenhuber mentioned the thermal shielding tiles used to protect manned space vehicles from the friction heat generated on their reentry into the earth's atmosphere.

The minister felt that western Europe no longer needed to strive for complete independence in all aspects of space travel. This attitude, which has to date been taken by the French in particular, had been superseded by recent political developments. Germany had never

aimed for such complete independence: Riesenhuber himself had always felt that it was far more important to develop Germany's space capabilities to the extent that would make it an effective all-around international partner. Mutual trust and interdependence were preferable to costly attempts to achieve self-sufficiency in space travel.

The European Space Agency (ESA) has hitherto shown less interest in collaboration with the CIS than has Germany; the Soviet Union's successors, on the other hand, do not have the resources to fund the very high membership fees paid by countries such as France, Germany, or Italy.

However, in order to leave the door open to the Russians, Riesenhuber is now proposing allowing the CIS to make payments in kind to ESA instead of membership fees. This could, for instance, take the form of transfers of Soviet technology for use in European space vehicles. Another possibility would be to offset western European scientists' and engineers' use of Soviet test facilities against payments due to ESA, or to find alternative ways of offsetting payments.

As an example, Riesenhuber cited a Russian facility that does not exist in the same form in the West, namely a test stand that can be used to study the behavior of exploding launch rockets. An opportunity for western European experts to use it would be of great interest.

However, Riesenhuber considers there are three main obstacles to the greater space collaboration he would like to see even after Flade's launch. One of these is the attitude of Germany's own aerospace industry, which would understandably be reluctant to see orders that it could supply itself vanish abroad.

A second obstacle in Riesenhuber's view is the continued French preference for European self-sufficiency. Last but not least, he also feels that there are, as yet, no sufficient guarantees for the future of space travel in the CIS to justify firm plans for long-term joint projects.

German Aerospace Institute Opens Branch in East Berlin

92MI0399 Bonn *TECHNOLOGIE-NACHRICHTEN*
MANAGEMENT-INFORMATIONEN in German
29 Feb 92 p 9

[Text] The new research center set up in the Adlershof district of Berlin by the German Aerospace Research Institute (DLR), and incorporating the Neustrelitz satellite earth station, is the ninth such branch established by a major western German research institute. This center's significance for joint space projects with the former eastern block countries has led the Federal Ministry of Research and Technology (BMFT) to finance almost 70 project posts in Berlin and Neustrelitz over and above the 135 posts recommended by the Science Council, which will receive basic funding.

The center's research work will focus primarily on extra-terrestrial research and earth observation from space. It will form an integral part of German and European space programs and be fully in line with the decisions taken at the last ESA [European Space Agency] council of ministers' meeting held in Munich in November 1991. This meeting emphasized the necessity of comprehensive earth observation from space as a means of protecting and safeguarding our planet, and called, in particular, for close collaboration with the Soviet Union's successor states as regards missions.

The MOS [multispectral optoelectronic scanner] earth reconnaissance project and the "Mars 94" extraterrestrial project are important components of the planned scientific and technical collaboration with the CIS. Before German unification, the DLR and the former Institute of Cosmic Research were separately involved in both projects; this research is now being amalgamated and continued in Berlin.

German Microgravity Research Described

92WS0453B Duesseldorf *HANDELSBLATT in German*
1 Apr 92 p B10

[Article by Silvia von der Weiden: "Research in Weightlessness: Missile Program TEXUS"]

[Text] *HANDELSBLATT* - TL, 31 March 1992—An important goal of materials research under conditions of weightlessness (1/10,000 g) is the production of materials that are as homogeneous as possible and therefore of technically high value. The more than 100 individual experiments conducted by the German Rocket Program TEXUS [Technological Experiments Under Weightlessness], which have offered users from industry and research attractive opportunities for experimentation during the ballistic free flight phases, have yielded extremely valuable data in this matter.

The German Agency for Space Affairs (DARA) is responsible for the employment of the high-altitude rockets.

Under terrestrial conditions, fluids with components of various densities are unable to mix. In the smelting of metals, this effect, called segregation, prevents a uniform distribution of the various metal components in the material. An entire gamut of experiments is therefore currently occupied both with aspects of the basic research of still unexplained phenomena as well as with practical questions dealing with applications.

Specific applications are in the field of so-called monotectic alloys, i.e., melts consisting of components that normally do not mix. Today, besides the main component aluminum, aluminum-based slide bearing materials contain tin, which is relatively expensive, as an additional mixture ingredient. The tin provides the requisite sliding properties. In the search for lucrative admixtures, lead and bismuth are considered most promising.

Under terrestrial conditions, the homogeneous fine distributions of the admixtures in the aluminum base required for the sliding material cannot be achieved. However, the ballistic flight experiments showed that, under conditions of microgravitation, additional complicated physical effects sometimes arise. The theory underlying these effects is being studied in a related project.

Meanwhile, several German industrial enterprises have been able to convert the knowledge gained in the TEXUS flights into promising technological processes. Partially, the approach used was to compensate the disturbing effects by means of opposing forces. The first successes in the technical use of monotectic alloys have been able to be made on the basis of this approach.

Another priority in materials science is the study of liquid-gas systems. Since under conditions of reduced gravity, there is no buoyancy force, it would be expected that the precipitated distribution of gas bubbles in a material would be incomparably more homogeneous than could be achieved under terrestrial conditions. The practical benefits are directed both at the quality of fusion welding and to the production of metal foams.

As compared with today's powder-sintered foams, metal foams are more cost-effective and possess more stable material properties. Their use as insulating materials is much in demand. They are distinguished by a low specific weight, combined with good acoustic insulating properties and optimal heat conductivity. Unfortunately, experiments have revealed that, under microgravitation, convection cells and turbulence form in the melt which obstruct uniform dispersion of the gas bubbles. This being the case, it would be better to reserve judgment on possible future uses.

The melt-engineering production of metal alloys having extremely uniform distributions of the tiniest oxide particles (about 0.1 μm) is of particular interest in the field of refining structural parts. To date, it has not been possible to obtain such high-value alloys because of disrupting convective influences. Knowledge gained from the space program about the dominant influence of the interface phenomenon between particles and melts has been able to verify this.

Meanwhile, both user industries as well as university research institutes are trying to utilize this know-how in a related project for the development of more efficient turbine blades.

In the focal point of interest is the knowledge, also gained from the space program, of growing pure semiconductor crystals for the electronics industry. Because of the growth rates of crystals, there is great interest in using not just the special short-term experiments, but also the D1 manned Spacelab flights and the upcoming D2 mission for these experiments. The German Air and Space Society [DLR] is responsible for the project management.

Of prime interest in these investigations are observations of the growth phenomenon under the influence of reduced gravity force. Under conditions of microgravitation, microscopic inhomogeneities and streaks have also been observed to appear in doped silicon crystals. The causes for this occurrence are attributed to physical effects, which on earth are blanketed over by cruder phenomena.

All in all, the high-altitude TEXUS flights and the D1 Spacelab mission were able to provide much valuable information, the technical conversion of which at the industrial level will take some time.

EC Funding for Applied Technology, Thermonuclear Fusion, Human Genome Research

92WS0473A Paris LE MONDE in French 10 Apr 92
p 17

[Article by Philippe Lemaître: "Europe, Research and Development"]

[Text] Spending more, spending better... After Maastricht, after the budget programming bill (called the "Delors Packet 2") introduced in February (LE MONDE 11 February), which emphasized the need to act at community level to boost the competitiveness of Old Continent companies, we could hope to find a new impetus following the expression of the first thoughts concerning the implementation of such a priority.

The "communication" that the European Commission just submitted to the twelve member countries concerning the new R&D "strategy" that should be considered will be a disappointment: except for the promise to contribute more money, what it proposes is rudimentary and smacks at every line of things already seen and heard. There is no magic recipe to check the erosion of the community's competitiveness. Certainly, as the Commission does here to a certain extent, we should assess with humility the results of the efforts made and propose new tracks. But to mobilize energies it also seems necessary to affirm leadership. We are far from it! After observing that European competitiveness "showed obvious signs of decline," the Commission assigns part of the blame to insufficient R&D efforts, in particular in applied research, which is directly related to the production process. This is a "cause for concern" in sectors such as semiconductors, display materials, and personal computers.

Without breaking with the past, we must therefore complete the range of current programs with projects of greater technological priority, in fields that have been insufficiently explored until now (transportation, high-performance computing, flat-panel displays, environment technologies). The Commission wishes for increased cooperation between producers and users, from the start of the projects.

From 1988 to 1992, credits allocated to research rose from 2.6 to 3.8 percent of the EEC budget. They must get

much higher: the Commission proposes to leap from ECU2.4 billion in 1992 to ECU4.2 billion in 1997. The additional money—if not the additional moving spirit—would go to more specifically technological projects, close to the market, and to “big science” megaprojects (thermonuclear fusion, human genome), which seem to be highly rated.

Since we should never put off till tomorrow... The Commission proposes to increase immediately the credits allocated to the third outlines program which is currently being implemented.

ESA-Russian Contracts To Benefit Hermes Space Shuttle

92WS0473B Paris *LE MONDE* in French 7 Apr 92 p 4

[Article signed J.F.A.: “To Help Develop the Hermes Shuttle, the European Space Agency [ESA] is Willing to Sign Contracts With Russia”]

[Text] At the latest ministers’ conference in Munich (Germany), in November 1991, ESA members gave a mandate to ESA general director, Mr. Jean-Marie Luton, to contact the Russians in order to identify the technologies and facilities in the former Soviet Union that Europe might use for its space programs.

The contacts made in recent months are starting to yield results. To such an extent that, at a meeting of the ESA industrial policy committee, late in March, representatives of the 12 ESA countries unanimously approved a proposal to sign contracts with some 30 Russian research institutes and industrial companies.¹ Their goal is to identify, for both parties, sectors of activity that might benefit from the development of the European Hermes space shuttle program.

ESA experts claim to have identified some 50 technical fields that might lead to the signature of agreements for which the ESA would provide some ECU5 million (about 35 million francs [Fr]) within the next six months. These future agreements focus on the modeling of the earth’s atmosphere, the computation of paths, the modeling and simulation of the aerodynamic conditions that the Hermes shuttle will encounter, as well as on the training of astronauts, the development of their space suits, the development of ejection seats and special batteries, and the use of heat-shield materials.

The results of this cooperation between Russian and European institutes and companies should be the subject of a detailed review in November, in Spain, at the space ministers’ conference. In case of success, the minister might consider a closer cooperation on Hermes.

Footnotes

1. The following took part in the preliminary selection of possible Russian partners for Europe: the ESA, of course, and, on the Russian side, Glavkosmos, NPO Energiya,

NPO Molniya, TsAGI, TsNIIMash, and the new Ministry of Industry of the Russian Federation.

Aerospatiale Improves Ariane Performance

92WS0499A Paris *LA LETTRE HEBDOMADAIRE DU GIFAS* in English 5 Mar 92 p 2

[Text] Aerospatiale, industrial architects and builders of Ariane stages have made two innovations that should improve performance of the vehicle. Now, it will be possible to add another 130 kg to satellites lifted to transfer orbits. For flight V-49 lightened helium tanks were used for the first time with the second stage procuring a gain of 78 kg, thereby giving an additional 18 kg payload. These spheres are made of kevlar fibre wound around a thin titanium core. They are made by the Aerospatiale Aquitaine division on behalf of MBB/ERNO (DASA). Now, Aerospatiale has developed a new third stage, the H-10+, to be used for the V-50 launching. This new version is built around a tank lengthened by 32 cm but weighing 26 kg less than earlier versions. The gain has been obtained by the way the cylindrical panels are machined at the Aerospatiale Les Mureaux plant. Now, the third stage will be able to carry an additional 340 kg of liquid oxygen and hydrogen for an added 20 seconds of propulsion time and an additional 110 kg of payload. This adds up to an extra 130 kg of payload and will further consolidate the position of Arianspace. With increasing frequency, launchings exceed maximum rated performance of the 4.2 ton space vehicle during transfer orbiting. Together, these two innovations will make it possible to exceed the present 4.450 ton limit. Aerospatiale has already received orders for five of the H-10+ stages and all third stages will now be H-10+ types.

E1-Aerospatiale-5-3-1992—contact: Mrs. S. Compard - Phone: 33 (1) 23 92 29 09.

French Aerospace Industry Assessed

92WS0499B Paris *LE BULLETIN DU GIFAS* in English 12 Mar 92 pp 1-4

[Henri Martre, chairman of GIFAS, held a press conference on 12 March 1992 during which he reported French aerospace industry 1991 results—First paragraph is introductory paragraph printed in italics]

[Text] The following figures relative to the fiscal year 1991 are estimates obtained through a sampling of some 85 firms belonging to Groupement des Industries Francaises Aeronautiques et Spatiales (total membership: 207 firms). These 85 firms account for 95 percent of total revenue and activities of the profession. It must be borne in mind that these figures, while probably very close to what the final figures prove to be, are still only estimates. Consequently, no final conclusions may as yet be drawn.

Turnover

Total Production

Initial estimates indicate a growth in consolidated turnover of +1.02 percent (in current francs) and around 2.2 percent in volume (constant francs for 1991).

The figures differ for each of the major branches (in value and volume): Aircraft and missiles: +2.3 percent, -0.9 percent; Power Plants: +3.0 percent, -0.3 percent; Equipment: -3.0 percent -6.1 percent.

Compared to orders booked in 1988 and 1989 (respectively, 121 and 146 billion francs), the consolidated figure for 1991 (119.9 BF) may seem modest.

Although production cycles take 18 to 24 months, production should have been in the vicinity of 130 billion francs. Major reasons for this shortfall are:

- the persistent subvaluation of the U.S. dollar which is the currency of the aerospace branch and which, by the time payments became due, had fallen by around 15 percent (rate of exchange of the US dollar on 1 January 1989 = 6.2503 FF whereas on 31 December 1991 it had fallen to 5.3561 FF);
- a cut-back in production because of cancellations in foreign military orders as notified early in the year at the time of the Gulf War, combined with reductions in French military orders.

This situation was aggravated, particularly, for equipment manufacturers by a significant drop in orders for spare parts owing to the slump in the civil carrier trade. Faced by this crisis and the resultant financial difficulties, airlines reduced their stockpiles and orders were either spread out or postponed.

The tendency for civil orders to become preponderant as observed during the past five years, has again become apparent and has now reached 52 percent (48 percent in 1990). For the first time, the civil market has grown at the expense of the military market, which, in terms of value, has receded by nearly 6 percent, or 9 percent in volume.

Exports

In the very interests of the French nation, it is vital for the aerospace industry to export civil and military products.

Compared to the scale of our American competitors or even to emerging countries (Brazil, Southeast Asia), the domestic French market could never hope to offset the research and development costs generated by modern products nor would it ever have orders substantial enough to benefit by the lower costs of large scale production.

Unfortunately, prognostics indicate a falling off of export deliveries from 55,658 million francs in 1990 to

55,040 million francs in 1991, a loss of 4.3 percent in volume (in constant indexed francs).

The major cause of this fall in export activities is the contraction of military exports (-33 percent in current francs).

This situation came as no surprise, considering the dearth of major military orders during the past years, the international disarmament context and the reinforcement of North American positions in the Gulf countries. No immediate change is expected in this situation which has been in effect for the past five years.

In spite of the vigorous reactions of our American rivals, civil products continue to gain export markets, having grown in 1991 from 56 percent to 70 percent of deliveries.

Between 1990 and 1991, civil export revenue expanded in value by 24 percent, largely through such products as the Airbus, Falcon, ATR, Ariane, helicopters, satellites and jet engines of the CFM line.

In terms of production, these figures are the result of an exceptional level of civil orders in 1988 and 1989 for CFM turbojets, the Airbus and the Ariane.

Orders

Order books indicate a contraction of nearly 30 percent, at 93 billion francs, against 132 billion in 1990, and represent only 77 percent of 1991 turnover.

At the present stage, the reduction of orders is estimated at 26 percent for metropolitan France and 34 percent for export. In these figures civil deliveries show a 38 percent regression while military orders show 21 percent.

Several airlines cancelled orders in 1991 which further depresses the order situation. At present, the books show a contraction of around 8 percent and represent 1.96 year's activity against 2.16 years on 31 December 1990.

Commercial Balance of Payments

Figures concerning imports made by the profession and figures of the official organizations which compute foreign acquisitions by French aeronautical sources (government, airlines) are not yet available, which means that the commercial balance of payments cannot yet be estimated. It is expected, however, that the aerospace branch will again be the major contributor to a positive commercial balance of France.

Work Force

In 1991, to cope with immediate and medium term prospects, manufacturers adopted new policies to ensure continued competitiveness:

- increased production to reduce costs and maintain a level of industrial efficiency comparable to major competitors (robotization, mergers, etc.);

—Tailoring facilities more closely to demand for the medium term future (multi-annual social plans and training programs).

cut-back in personnel in 1991 followed probably by another 5 percent reduction in 1992, unless the world situation has significantly changed by then.

While the benefits of these two measures have not yet been evaluated, they are expected to result in a 2 percent

Exports + Domestic

Total	Aircraft & Missiles	Power Plants	Equipment	Total	In MF Δ% 91/90
Total 1990 (current F)	62,891	26,003	29,659	118,553	+1.1%
Total 1990 (1991 F)	64,967	26,861	30,637	122,465	-2.2%
Total 1991	64,354	26,779	28,772	119,905	

Export Turnover (as estimated for 1991)

Total	Aircraft & Missiles	Power Plants	Equipment	Total	In MF Δ% 91/90
Total 1990 (current F)	33,770	14,594	7,294	55,858	-1.1%
Total 1990 (1991 F)	34,884	15,076	7,535	57,495	-4.3%
Total 1991	32,879	14,685	7,475	55,040	

Domestic Turnover (as estimated for 1991)

Total	Aircraft & Missiles	Power Plants	Equipment	Total	In MF Δ% 91/90
Total 1990 (current F)	29,121	11,409	22,364	62,895	+3.1%
Total 1990 (1991 F)	30,082	11,785	23,102	64,970	-0.2%
Total 1991	31,475	12,094	21,296	64,865	

Non-Consolidated Aerospace Turnover (As estimated for 1991)

Primary sources: 85 GIFAS member firms; = 95% of total turnover; PNB price index, GIFAS estimate of 1991 value: 1.033.

On the basis of internal exchanges within the profession during 1991 which followed a growth similar to that of the

total turnover figure for the same period, it is possible to estimate the consolidated turnover at around 102 billion francs which represents +1.02 percent in current francs and -2.2 percent in terms of constant francs.

Breakdown of Civil and Military Deliveries (as estimated for 1991)

	Export		Domestic		Total	
	Total 1990	Estimated total for 1991	Total 1990	Estimated total for 1991	Total 1990	Estimated total for 1991
Civil	56%	70%	41%	36%	48%	52%
Military	44%	30%	59%	64%	52%	48%

Aerospace Orders Booked (as estimated for 1991)

Exports + Domestic (in million of current francs)

Total	Aircraft & Missiles	Power Plants	Equipment	Total	Δ% 91/90
Total 1990	87,155	20,605	24,815	132,375	-29.9%
Total 1991	51,993	16,396	24,441	92,830	

Export Orders (as estimated for 1991) (in million of current francs)

Total	Aircraft & Missiles	Power Plants	Equipment	Total	Δ% 91/90
Total 1990	47,870	9,506	5,565	62,941	-33.8%
Total 1991	28,454	7,398	5,793	41,645	

Domestic Orders (as estimated for 1991) (in million of current francs)

Total	Aircraft & Missiles	Power Plants	Equipment	Total	Δ% 91/90
1990	39,285	11,099	19,050	69,434	-26.3%
Total 1991	23,539	8,998	18,648	51,185	

The 1991 order books indicate 235 billion francs as against 256 for 1990, hence, a contraction of 8 percent in current francs.

Breakdown of Civil/Military Orders (as estimated for 1991)

	Export		Domestic		Total	
	Total 1990	Estimated total for 1991	Total 1990	Estimated total for 1991	Total	Estimated total for 1991
Civil	74%	69%	38%	33%	55%	49
Military	26%	31%	62%	67%	45%	51%

AUTOMOTIVE INDUSTRY

BMW Opens Press Tool Factory in Eastern Germany

92MI0345 Bonn DIE WELT in German 11 March 92 p 17

[Excerpt] The Eisenach automobile center is taking shape: Barely a year after building work started, a BMW plant was opened yesterday, in the presence of Federal Finance Minister Theo Waigel and Thuringian Minister-President Bernhard Vogel. At the end of this year Adam Opel AG will open its assembly plant, which will produce 150,000 Kadett and Corsa cars per year, while Robert Bosch GmbH will shortly begin producing electrical components in the same region.

The BMW automobile factory GmbH, Eisenach, which has just been officially opened, is building large-scale tools for presses used to manufacture vehicle body parts. Production at the 85,000 square-meter site is geared to expansion, with an investment of 120 million German marks [DM] intended to create an initial 210 jobs by the end of the year, a figure scheduled to double later. The labor force has been in training at BMW's Dingolfing factory for over a year.

"This factory has arrived at the right time," said BMW chairman Eberhard von Kuenheim, adding that the automotive industry was currently experiencing supply problems regarding machine tools and tool manufacturing. Working in conjunction with the Munich and Dingolfing production centers, after a running-in period the Eisenach factory will supply around 40 percent of its DM100 million output to other companies.

Kuenheim stressed that, by opening the new factory, BMW had confirmed its commitment to manufacturing in Germany; even though operating conditions in Germany had become less favorable, modern manufacturing plants were needed in the eastern part of the country. He

warned, however, that "continued governmental initiatives and clear priorities are absolutely essential, if business growth is to continue." Von Kuenheim added that it had not been "emotional factors" that had swung the decision in favor of Thuringia, where, back in 1938, BMW which until then had manufactured only aircraft engines and motorcycles, had acquired the successor to the Eisenach Vehicle Factory, founded in 1896, thus ushering in the BMW automobile era.

Germany: Electric Waste Collection Truck Developed

92MI0436 Wuerzburg UMWELTMAGAZIN in German No 4, Apr 92 p 84

[Text] Since the air in inner cities is heavily contaminated as a result of the huge number of vehicles, domestic boilers, businesses, and industrial firms, this is where electric vehicles are particularly useful. They emit no exhaust fumes and run virtually without noise at low speed. From the point of view of the energy consumed by the electric drive, power station generation causes only a fraction of the emissions produced by an internal combustion engine. For this reason, more and more manufacturers are offering electrically powered utility vehicles for local authority use.

The Pfau company of Springe, together with RWE [Rhineland-Westphalia Electricity Company], have thus developed an electrically-powered municipal vehicle which, with an overall weight of 2.1 tonnes, still allows for a useful load of 400 kg, despite the high battery weight. The vehicle is equipped with a garbage collection container and is specially designed for the manual discharge of paper and refuse bins in inner-city areas, pedestrian precincts, parks, etc.

The comfortable, spacious driver's cab makes for fatigue-free operation even in all-day use. The sliding hatches of the container can be opened and closed without any great effort. The garbage container is emptied via the tailgate in a tilted position.

The electric motor is powered by batteries with a capacity of 160 ampere-hours. Charging takes a maximum of 11 hours via the built-in charger (220 V) or about four to six hours with a static charger (380 V). At a constant speed of 50 km/h, the vehicle's range is approximately 80 km, about 55 km in the urban cycle. This range generally equates to one day's downtown use, so the battery can be charged overnight without problems. The built-in charger can be connected to any 220-V power point. Moreover, the top speed of 70 km/h ensures short journey times to and between jobs, and even allows highway driving.

European Auto Makers Present Electric Cars

92WS0447C Paris AFP SCIENCES in French
19 Mar 92 p 49

[Unattributed article: "The Electric Car Is Betting on the Future"]

[Text] Geneva—They are often efficient but expensive, and large car manufacturers are getting interested. This year, electric cars powered by batteries, sometimes solar batteries, had their first special exhibition at the International Automobile Show that closed in Geneva on 15 March.

According to experts, it is not a coincidence if research on electric cars powered by rechargeable or solar batteries is ahead in Switzerland, where 1,200 people already drive electric cars. The country does not manufacture cars, but buys a lot of them. Moreover, "ecological awareness" is increasing. Several Swiss spas, e.g. Zermatt, are already using electric buses, and on 4 March, when the show opened, Horiacher beat the world record for the longest nonstop trip without recharging the battery, i.e. 547 km.

Last year, the solar-powered prototype "Spirit of Biel," from the Biel Engineering School beat the Japanese in the race across Australia. For its part, the giant chemical company Ciba-Geigy has just developed a small solar-powered car that can reach 125 km/h and cover 400 km nonstop.

Mr. Jean Temperli, the show organizer, does not quite believe in "the future of purely solar-powered cars, except in the case of small machines, e.g. on golf courses, because the vehicles have to be very light and the photovoltaic cells huge." Mr. Temperli is the secretary of the Swiss Association for Electric Road Vehicles (ASVER), which organizes an Electric Grand Prix race every year in Zurich, in May, as well as a road championship in September to test any technical progress in electric cars.

According to Mr. Temperli, it will take efficient, lightweight, and especially competitively-priced batteries—based on the new sodium batteries (NAS) developed by AEG (German [General Electric Company]), Lucas, or

ABB (Swedish General Electric Corporation [Asea-Brown Boveri])—to make possible series sales of electric cars. For this, we can expect to wait until the end of the century.

The electric Clio (Siemens-Renault partnership) shares these prospects: marketing small utility vehicles for city use in 1992-1993; launching small city cars in 1995-1997; and series production of long-range road vehicles plugging in at widely available electric terminals by 1997-1999.

Next to small companies, like the French Jeanneau, which is beginning to market well-equipped Microcars (80 km range, 10 hours to recharge at home), large car manufacturers are in the race toward less polluting engines. Last year, Peugeot introduced a Citela small car and a city scooter. BMW introduced an "all-electric" car in September, in Frankfurt. Nissan designed hydrogen engines. Skoda is already selling electric vans and sedans (100,000 francs).

In Geneva, Opel introduced its Twin, a compact streamlined car that uses only 3.5 liters of gasoline per 100 km. The driver can choose between electric and gasoline propulsion. Others are also considering hybrid engines, e.g. the Audi Duo. Fiat is selling its Cinquecento in two look-alike versions, with gasoline or electric propulsion for city driving. As for Volkswagen, it is working on a Golf City Stromer that might short-circuit the Swatchmobile on which the Swiss Nicolas Hayek, the father of the Swatch watches, is working in secret.

Finland: 'City Diesel' Cuts Sulphur, Particle Emissions

92WS0499H Toddington NEW MATERIALS
INTERNATIONAL in English Mar 92 p 7

[Text] Year-long trials are underway in Helsinki, Finland, with a new type of diesel fuel that promises to cut both sulphur and particulate emissions from public transport vehicle exhausts.

The fuel, known as City Diesel, has been developed by Finland's Neste Oil company following a survey of the needs of engine manufacturers. Its low sulphur content—0.05 percent compared to 0.1 percent to 0.2 percent for normal diesel grades—plus a smaller content of aromatic compounds, has resulted in 10.30 percent less particle emissions while under test by Volvo, Saab-Scania and the Swedish Environmental Protection Agency.

The test showed that sulphur emissions are a fraction of those of other diesel fuels. City Diesel also generates slightly lower carbon monoxide and nitrous oxide (NOx) emissions, and it was found that its low-sulphur content allows the use of catalysts or particle filters and has the potential to extend engine life by as much as one-third.

Neste produced the first quantities of City Diesel in 1990 and, following tests by Swedish public transport authorities, the fuel underwent trials throughout 1991 in 140 Helsinki buses to study its ability to cut exhaust emissions in urban areas and how effectively it can do this in winter.

City Diesel follows Neste's success earlier in the spring of 1991 with the launch of the first European-produced reformulated blend of gasoline that is capable of significantly cutting emissions from petrol-engined vehicles by between 10 and 20 percent. City Gasoline cuts the toxic content of exhausts through a higher oxygen content that improves combustion, and a lower than normal content of aromatic compounds, benzene and sulphur. The lower vapour pressure cuts the VOC emissions by approximately 15 percent.

Completing a trio of developments, the Finnish oil company has also introduced a new, fully-synthetic, multigrade motor oil called Neste KAT that meets the special needs of cars equipped with catalytic converters. It is claimed to reduce oil consumption and oil changes, cut fuel consumption, keep engines cleaner and maintain the performance of catalytic converters.

BIOTECHNOLOGY

Denmark: Company Introduces Gene-Spliced Sugar Beets

92P60205 Copenhagen *BERLINGSKE TIDENDE* in Danish 2 Apr 92 Section III p 1

[Txi] Genetic experiment: the Maribo Fro company has used genetic splicing to produce a generation of sugar beets which are resistant to a weedkiller which is very safe for the environment.

The first genetically spliced sugar beets are coming to the sugar beet fields. Maribo Fro is ready to plant the third generation of the so-called "round up" beets, which may be the last test generation before the beets come on the market.

Maribo Fro is working with an idea from the American Monsanto Company, and the Maribo Fro company, located in Lolland, is the first one here which itself has inserted new genes. The problem with the earlier market testing was that the beets did not tolerate the "round up" weedkiller, which is safe for the environment.

"The 25,000 new beets which we are now ready to plant can tolerate weedkillers, since they have received new genes," says Maribo Fro's head of research, Hans Christian Pedersen, who foresees both environmental and economic gains.

The weedkiller which the beets resist is not nearly as poisonous as other products on the market, and it is also cheaper.

Round Up affects green plants and also beets, if their genes are not altered. Round Up's poison is quickly broken down in the soil. As a result of the new legislation on the environment and genetic technology, both the Ministry for the Environment, which has previously given Maribo Fro permission twice to do experiments with genetically altered beets, and the EC Commission will give green light to marketing of beets with altered genes.

Italy: Gene Transplant Performed to Cure Immunodeficiency

92MI0348 Milan *L'INDIPENDENTE* in Italian 13 Mar 92 p 5

[Article by Daniela Vincenti: "Revolutionary Treatment"]

[Text] It is the first operation of its kind in the world and the third in Europe. Last Monday at the San Raffaele hospital in Milan, Dr. Claudio Bordignon, in collaboration with the Pediatrics Department of the University of Brescia, performed a "gene" transplant operation on a child with SCID [Severe Combined Immunological Deficiency], a congenital immunodeficiency caused by the absence of adenosine deaminase (ADA). The lack of ADA, an enzyme participating in cellular metabolism, leads to an accumulation of toxic molecules that kill lymphocytes, a type of leukocyte that plays an important role in the body's immunological defense system.

According to Dr. Bordignon, this operation paves the way for further applications not only in the field of congenital and hereditary diseases, but also in the area of nonhereditary and infectious diseases such as AIDS or cancer. "Although the solution is not yet close at hand, we have already passed the theoretical stage because we already know what to do," stated Bordignon.

But what is "gene therapy"? Here is Dr. Bordignon's explanation: The whole idea is based on the assumption that the ultimate cure for a disease may come from the correction of the defective gene. Using this technique, retroviruses that are no longer capable of propagating within the organism are used as carriers of a genetically-engineered gene containing the new genetic makeup. Obviously, as Dr. Bordignon emphasized, the gene transfer only occurs in the somatic cells of peripheral blood or bone marrow, that is, in cells incapable of changing the patient's genetic and hereditary traits. Once the transfer has taken place, the cells are reintroduced into the patient's body as in a normal blood transfusion.

The above operation was performed on a five-year-old boy from Calabria, who is only known by his initials, G.B. When G.B. was 11 months old, he was referred to the Brescia Pediatrics Department, the only center in Europe for congenital immunological deficiencies. The director of the Brescia clinic Alberto Ugazio stated: "The boy was seriously ill. He was suffering from a large number of infections and severe diarrhea accompanied by weight loss." After immediately diagnosing the

almost complete lack of lymphocytes in G.B.'s blood, the doctors decided to place the boy under a sterile plastic "bubble".

The approximately 50 children who suffer from SCID worldwide have few therapeutic choices. The only therapy that has an 80 percent success rate is a bone marrow transplant. In G.B.'s case, however, none of his brothers turned out to be compatible. Doctors, therefore, treated the boy with transfusions of erythrocytes that supplied the lacking ADA and detoxified the body. Frequent transfusions, however, lead to severe complications. Therefore, G.B. was administered PEG-ADA, a drug made with bovine ADA. After an initial improvement, however, the boy's immunological system developed antibodies specific for the drug.

Given the situation, the only possible solution seemed to be the "gene therapy" that had already been carried out by Dr. F. Andersen and Dr. M. Blaese in the United States over a year before.

Upon approval of the National Bioethics Committee, G.B. underwent the first operation in which the gene transfer was only performed in peripheral blood. Within a month the boy will undergo a similar operation on the bone marrow. Dr. Bordignon has stated that this second stage sets the Italian therapy apart from the American therapy that was carried out on blood lymphocytes only. Dr. Bordignon, who is optimistic about the results of the treatment, has postponed a final statement.

This opens up a glimmer of hope for other genetic diseases. Professor Alberto Ugazio maintains that apart from SCID the new "therapy" may also be used to treat the following five diseases: Lesch-Nyhan syndrome (a form of dementia), cystic fibrosis, muscular dystrophy, hemophilia, and putino-nucleosider [as published] phosphorylase deficiency (another severe type of immunodeficiency). Normal genes for these diseases have already been isolated and cloned. However, a diagnostic effort is also required: About 75 percent of children suffering from immunodeficiency die before the disease is even diagnosed.

German Law on Genetic Engineering Discussed by Industry

92MI0398 Bonn *TECHNOLOGIE-NACHRICHTEN*
MANAGEMENT-INFORMATIONEN in German
29 Feb 92 p 2

[Text] Problems over liability arising from the law on genetic engineering were raised by the CDU/CSU [Christian Democratic Union/Christian Social Union] parliamentary group at the start of a public hearing on "experience with the law governing matters of genetic engineering," to which scientists, ecologists, and representatives of industry, management, and labor unions had been invited by the Research and Health Committee.

Small and medium-sized enterprises, whose genetic engineering products are uncompetitive in the German market, were particularly affected, it was claimed. Although larger industrial companies could afford the financial investment, the CDU/CSU saw a risk that liability issues might encourage them to emigrate "to friendlier countries with better local conditions." The SPD [Social Democratic Party of Germany] considered that the laender had particular problems with the new requirements, owing to the great uncertainty still prevailing among the licensing authorities. Alliance 90/The Greens stated their basic position as follows: "The genetic engineering law still presents weaknesses. It is important to amend the law's general provisions so as to ensure real protection for the population."

"The safety levels are treated in more or less the same way for the purposes of implementing and applying the law," commented Professor Ernst Winnacker of Munich University. He considered that safety level 1 should require less documentation than level 4, as level 1 entailed a lesser hazard to human health and the environment. Furthermore, 97 percent of research applications fell under level 1 stated Winnacker, so an amendment to the law could substantially facilitate research. Professor Helmut Altner of the Committee of University Rectors stressed that the cost incurred in complying with the law could no longer be borne by the already over-stretched universities. Regarding the practicality of the existing legal regulations, Professor Gerd Hoborn of the Central Commission on Biological Safety [ZKBS] criticized the fact that there were still no provisions governing the dispatch of genetically engineered organisms across national frontiers. Dr. Martha Martens of the Munich ZKBS pointed out that there was a more urgent need to legislate on the transport of substances that represented a higher hazard potential.

There are still substantial discrepancies between EG standards and national regulations as regards practical aspects of the German law on genetic engineering. For example, Dr. Ludwig Kraemer of the EC Commission voiced the criticism that Germany currently had no plans for lifting restrictions on the marketing of genetically manipulated organisms for testing and field research.

French Researchers Developing Vaccine Against Intestinal Parasites

92WS0435B Paris *LE MONDE* in French 19 Mar 92
p 1, 12

[Article by Franck Nouchi: "Vaccines Offer Hope for Development"; *LE MONDE* introduction is "Human experimentation of an antischistosomiasis vaccine will offer great possibilities for combatting parasitic illnesses."]

[Text] What if the fight against parasitic diseases were not lost after all? And what if, contrary to a belief that is

only too common, it became possible to imagine the scourge of endemic parasitic illnesses conquered by vaccines?

Are we finally overcoming the fatalistic attitude with which we too often overwhelmed developing countries—often for lack of any effective aid?

Judging from the contents of certain papers read at the Annecy conference, many researchers are no longer resigned to fighting a lost cause. "After all," summed up Professor Andre Capron, director of the National Health and Medical Research Institute's (INSERM) Immunology of Infectious and Allergic Diseases Unit at the Lille Pasteur Institute, "the international community did not really step up its aid and efforts to combat parasitic illnesses, until 20 years ago. It takes time to develop a vaccine. So it is entirely natural, under the circumstances, that it took us until now to realize that vaccines are feasible."

All, then, is not lost. Indeed, backing up his words with deeds, Professor Capron announced that human experiments of an antischistosomiasis vaccine would be conducted under the aegis of the World Health Organization (WHO), probably before the end of the year. Schistosomiasis is one of the most widespread parasitic diseases in the world. Discovered in 1951 by Theodore Bilharz, it exists chiefly in tropical and subtropical regions.

The parasite responsible for the disease is a small, flat worm, the schistosome, of which five types pathogenic to humans are known. About 200 million people, most of them children and adolescents living in Africa, South America, and Asia, are now afflicted with schistosomiasis. And between 200,000 and 500,000 of them die of it each year.

"Spectacular Effects"

The parasite enters the organism by way of water or contaminated food. Once there, it passes through a fairly complicated cycle that finally brings it to the liver. There it causes various disturbances that affect the intestines, urinary tract, blood, etc., and that manifest themselves clinically in a bloated liver and spleen (hepatosplenomegaly) and portal hypertension.

The female worm that causes the disease can lay several hundred eggs a day that infest the entire organism. Epidemiological studies conducted in Gambia, Kenya, and Brazil have shown that immunity against the disease appears fairly late, at puberty. Professor Capron's team has also shown that the primary antibodies induced by introducing the parasite into the organism are IgE immunoglobulins.

Later, a lengthy and meticulous study at the Lille Pasteur Institute identified and cloned a protein that apparently has great protective powers. Dubbed P.28, it was genetically engineered by researchers under the direction of Professor Jean-Pierre Lecoq at Transgene in Strasbourg (see LE MONDE, 28 March 1987).

The protein has since been purified, crystallized, and tested in animals. Several studies have shown that it can reduce the production of parasites by nearly 75 percent. Better yet, when administered to infected baboons, it simply wipes out bladder lesions.

"Thus, the P.28 vaccine prototype," sums up Professor Capron, "has spectacular effects on both parasite fertility and the viability of parasite eggs." Experiments with the vaccine on cows in Sudan slashed production of parasite eggs by nearly 80 percent. (Some types of schistosomes, especially in Africa, infest livestock, causing significant growth delays and substantial weight loss.) Human experimentation of the vaccine, which should begin in a few months under the aegis of WHO, was the next step. If the vaccine were to prove effective, it would be the first antiparasitic vaccine ever devised.

In addition to their scientific value, these studies illustrate perfectly the need for researchers, manufacturers (in this case, Pasteur-Merieux Serums and Vaccines), and the big international organizations to cooperate closely in vaccinology.

The Importance of European Firms

The new development of the last few years is the steadily growing role played by European firms in the vaccine industry.

In Annecy, Mrs. N. Baudrihaye of the European Federation of Pharmaceutical Industry Associations (EFPIA) pointed out that 67 percent of the vaccines used by UNICEF between 1985 and 1991 were European-made. The trend coincides with a huge, worldwide movement to restructure the industry. Over the last few years, Merieux has taken over Pasteur Vaccins and Canaught, Wellcome has sold its vaccine business to Evans Medical (a subsidiary of Medeva), SmithKline, itself a division of Beecham, has acquired the Belgian company RIT, and the Italian firm Scalvo was incorporated into Biocine, a subsidiary of Ciba-Geigy, and so on.

It looks as if a few years from now not more than four or five large groups will still manufacture vaccines. Such a concentration is not without its problems. Unlike the traditional pharmaceutical industry, the vaccine industry does not generate huge profits. And the low living standard of populations with parasitic diseases means that the industry must even produce at a loss. Under such conditions, it is vital not only to establish the type of cooperation mentioned above, but to involve governments in the research effort to develop new vaccines.

New vectors will probably make it possible within a few years to administer several different vaccines in one injection. With 88 of the 92 million births occurring each year in developing countries, the potential importance of such strides is evident. But lest we harbor any illusions, we should remember that this progress has a price. Not so much the price of the vaccine, which accounts for only 7 to 10 percent of the cost of a mass vaccination

program, but of the salaries of the health-care workers who implement the program (about 60 percent of the total cost.)

Political leaders are usually more than willing to acknowledge that health is a major factor in a country's economic development. And they agree that underdevelopment is a factor in an instability that, in the long run, may be very harmful to industrialized countries. When will they move from words to deeds and give real meaning—at last—to their aid policies for developing countries?

COMPUTERS

German Institute Unveils 'Computer Assistant' Prototype

92MI0404 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 18 Mar 92 p 3

[Text] The computer assistant will establish a new division of labor between man and computer. The Society for Mathematics and Data Processing (GMD) Institute of Applied Information Technology has developed initial prototypes for such systems, and has just demonstrated their basic viability at the Hannover CEBIT computer fair. Since today's personal computer does not yet achieve what its name implies, in the long term the computer assistant aims to perform functions similar to those carried out by a human personal assistant. The system is intended to perform more tasks than computers have done to date—especially jobs that humans find tiresome and difficult. However, the computer assistant is not intended to automate completely the maximum number of tasks.

Not a Replica of the Human Mind

The GMD scientists' computer assistant concept is not an attempt to replicate human assistants. Their intention is rather to simulate in a machine system certain features required or desirable to provide effective assistance, though without making any claim to cognitive adaptivity. If computers are to serve as assistants, they need to be equipped with both expert knowledge and knowledge of the user. An additional requirement is for systems to have knowledge of themselves, i.e., of how they themselves operate. Only if a system can observe and reflect on its own behavior is it capable of, for example, assessing its own scope and understanding its behavior.

Scope and Limitations

The GMD's Institute of Applied Information Technology is working on the following features:

- **Technical Scope:** computer assistants need to be equipped with expert knowledge in specific fields, and to be in a position to provide problem-solving support in those fields;
- **Knowledge of Systems and Their Scope:** Within their own domains, computer assistants must be able to

provide information about their scope and its limits. The user must be able to find out from dialogue with the system the problems it can solve and the ones it cannot, and why;

- **Machine Learning and Adaptive Behavior:** Computer assistants need to be able to adapt both their behavior and the services they perform to the user's individual requirements and personal style;
- **Processing of Inaccurate Instructions:** They must be capable of interpreting ambiguous and even contradictory instructions on the basis of knowledge of the user and the task currently in hand;
- **Explanatory Capability:** Systems must be capable of explaining and justifying any of their actions, the conclusions that they reach, and the information they provide;
- **Combined Support:** Computer assistants must support not only the work of an individual but also the combined work of teams and organizations. They will thus be able to help coordinate tasks organized on a work-sharing basis.

ENERGY, ENVIRONMENT

Netherlands: Geothermal Heat Considered as Energy Source

92BR0259 Rijswijk POLYTECHNISCH TIJDSCHRIFT in Dutch Mar 92 p 8

[Article: "Profitable Terrestrial Heat is Not Really Getting Off the Ground"]

[Text] Geothermal energy in the form of hot water pumped up from the subsoil can be used profitably in the Netherlands to heat houses, offices, and horticultural greenhouses. In addition, the use of this environmentally safe source of heat is almost the cheapest way to reduce CO₂ and NO_x emissions. The full exploitation of geothermal heat resources available in the Netherlands could result in a savings of 3 to 4 billion cubic meters of natural gas per year.

This was written by Professor Dr. F. Walter from the Faculty of Mining Engineering and Oil Development in a recent issue of DELFT INTEGRAAL, the scientific magazine of the Technical University of Delft. In neighboring countries with the same geological characteristics as the Netherlands', hundreds of thousands of houses are already being heated this way, whereas the Netherlands does not even have one single power station. According to the professor from Delft, this lack of interest in geothermal heat is attributable to the energy companies' unfamiliarity with it and the huge gas reserves available in the Netherlands.

This calls for a brief explanation. If someone were to descend deep down into the earth, it would not be necessary to take along many clothes. Every 100 meters, the temperature increases by roughly 3°C. The permeable, porous layers (aquifers) that are found at a depth of 2,000 meters hold water which has a temperature of 60

to 70°C. By pumping up hot formation water and by passing it through a heat exchanger, about 4,000 houses can be heated per doublet [source and drain wellbore]. Because formation water is salty, it is reinjected into the aquifer via a second wellbore after use. Together, these wells form a doublet. In the Netherlands, geological conditions are propitious to the production of geothermal energy. According to Professor Walter, an aquifer at a depth of 2,500 meters with a temperature of 80 to 90°C can supply between 7 and 9 MW of heat.

The costs involved in geothermal heat exploitation in the Netherlands should not be prohibitive, since part of the infrastructure needed is already there in the form of wellbores and urban heating networks servicing 150,000 houses. Every year, five test bores are made which produce only hot water instead of oil or gas. By adding a second well to such an existing well, the required doublet is obtained. Professor Walter calculated that this would reduce the start-up expenses for a geothermal power station by more than 6 million guilders to only 13 million guilders.

In 1992, the NAM [Dutch Oil Company] is going to carry out an exploratory drilling in Delft-South. If only water is found instead of oil, it will surrender the well for the production of geothermal heat.

EC Long-Term Environment Plan Outlined

92BR0266 Groot-Bijgaarden DE STANDAARD
in Dutch 11 Mar 92 p 1

[Article by Antoon Wouters: "EC Commission Revises Environmental Policy and Rejects Idea of New Nuclear Power Stations"]

[Text] Brussels—During the next few months, the EC Commission will put finishing touches on a completely revised version of its environmental policy with a view to achieving "sustained development" in the EC by the end of the century. Sustained development means that present generations meet their own needs without jeopardizing the development of future generations. The Commission therefore rejects the implementation of new nuclear power stations, turning instead toward renewable sources of energy for the production of electricity.

The draft paper, entitled "Towards Sustainability," to which our editorial staff had access, provides another, prozaic definition of sustained development: "Do not eat today the seeds of tomorrow's harvest."

Challenge

The decade of the 1980s was an era marked by the establishment of the single market. The challenge for the 1990s will be the achievement of sustained development. According to the EC Commission, durable economic growth can only be achieved if the environment is not regarded as an obstacle, but as a vehicle toward efficiency and competitiveness.

A major change in the revised policy is the fact that pollution and environmental damage will no longer be allowed to occur, but that action will be taken upstream from products and activities in order to prevent pollution.

It is absolutely out of the question that new nuclear power stations will be built in order to generate the 11 billion watts of electric power needed. The emphasis will lie on renewable sources of energy.

At the environmental summit in Dublin (June 1990), the EC ministers of the environment adopted the principles of sustained development and prevention. The Fifth Environmental Action Program is designed to achieve that goal by the year 2000.

Between 1992 and 1995, the EC Commission will reorganize EC policy in that sense, and between 1996 and 2000, it should be fully in effect.

Main Goals

The new environmental policy must be implemented in a period of major changes: the single market, the development toward economic and monetary union, the pursuit of political union, the political and economic changes in Central and Eastern Europe, and policy revisions in the fields of structural funds, agriculture, transportation, and energy.

The EC Commission intends to establish a framework of cooperation with industry, because industry does not only play a role in causing environment problems, but also in solving them.

The main goals include the integrated monitoring of pollution through licenses, taking inventory of emissions, making environmental audits, levying environmental taxes, and implementing the cleanest possible technologies. Through economic and fiscal measures, a system of deposits, and strict dumping regulations, waste piles could be reduced. The manufacture of environmentally safe products is stimulated through the introduction of the "Eco-label," product standards, increasing consumer awareness, and tax benefits.

The energy sector is a cornerstone in the sustained development policy, and requires a strategy reaching far beyond the year 2000. In the short and medium terms, the Commission will focus on energy saving and on the development of technologies to reduce carbon emissions.

Through economic and fiscal incentives, the emission of CO₂, SO₂ and NO_x will be restricted. Alternative and renewable sources of energy—such as biomass, wind, tidal, solar, hydrothermal, and geothermal energy—will be encouraged.

In the field of transportation, EC Commissioner Van Miert published a "Green Paper for Sustained Mobility" last month. In this field, the EC aims at cleaner cars and fuels, EC control on the number of cars, the reduction of fuel evaporation, and a better infrastructure. Awareness

campaigns and economic and tax measures are expected to urge citizens to adopt a different driving and traveling attitude.

Balance

The present common agricultural policy is conducive to overdevelopment and to the pollution of agriculture's natural resources, in other words to soil, water, and air pollution. In addition, there is the problem of agricultural surpluses as well as sociological problems due to the depopulation of rural areas.

The balance can be restored by returning to extensive and organic farming, by reducing the use of pesticides, by implementing development programs for rural areas, and by reforestation and long-term afforestation.

Finally, the EC points out that the tourist sector is causing more and more environmental problems and that a policy of sustained tourism is urgently required if tourists are not to be swamped by their own dirt.

Germany: Alternative Energy Sources Discussed

92MI0344 Bonn WISSENSCHAFT WIRTSCHAFT TECHNOLOGIE in German 4 Mar 92 p 5

[Text] Phosphoric acid cells for natural gas-fired combined heating and power systems with electrical outputs in the 100 kilowatt to 11 megawatt range were demonstrated at the 11th Conference on Hydrogen Power Engineering in Nuernberg at the end of February.

Other types of high-temperature fuel cells are also under development and appear suitable for large-scale electricity generation. Using fuel cells to generate electricity is expensive (mobile: 30,000 - 50,000 German marks [DM]; stationary: DM2,000 - DM5,000 specific costs per KW of electricity). In theory, electrochemical combustion of hydrogen in fuel cells is capable of 70-90 percent efficiency. Alkaline and membrane cells operating below 100°C are limited to military and space applications. Development programs have given an innovatory thrust to electrolysis of water.

The conference was organized by the "Renewable Energies" specialist committee of the VDI [Association of German Engineers] Power Engineering Association and by the VDE [Association of German Electrical Engineers] Power Engineering Association, in collaboration with the German Aerospace Research Institute, Solar Energy and Hydrogen Research Center, Bavarian Solar-Hydrogen, and the Society for Introducing Hydrogen into Energy Management. Around 300 experts took part in the conference, which was led on the scientific side by Professor Carl-Jochen Winter VDI, Dr. Manfred Fischer, and Eng. Martin Fuchs VDI.

The conference discussed the latest technical and scientific results and the short- and medium-term options, from which it emerged that only a few collectible energies can be used in means of transport, as the energy has to be carried on board, refueling has to be possible,

handling has to be simple and safe for the lay person, and the energy has to be available in large quantities and at low prices. The major reasons for studying hydrogen as a new source of energy are to protect the environment and to maintain the long-term availability of fossil fuels. Any change in source of energy triggers a chain of consequences. Pilot projects were presented.

Innovations grow out of research, development, demonstration, and marketing of technical components and the systems that they make up. The solar hydrogen energy system only achieves efficiency rates of below 10 percent. From the energy point of view it is important to take advantage of the high efficiency rates of fuel cells to enable the entire system to attain acceptable efficiency rates. Germany leads the field here with a number of systems and projects.

Great imagination and creativity were shown by the designers who presented their hydrogen-fueled world of the future at Nuernberg. Nevertheless, discussion of these ideas returned to the basic point that hydrogen is not a naturally occurring energy source. If hydrogen is produced from primary energy by water electrolysis, the fact remains that all hydrogen energy was previously electricity. There are thus advance plans for structural changes in energy management: Wherever possible, primary energy sources will be used on the spot, and the use of electricity will be stepped up. It is difficult to identify immediate scope for using hydrogen within the present system.

World Support For German CO₂ Emission Policy Falters

92MI0409 Bonn DIE WELT in German 28 Mar 92 p 2

[Article by Heinz Heck: "Falling Between All Stools"]

[Text] Federal Environment Minister Klaus Toepfer seems determined. "The threat of climate change makes action on a global scale imperative," he stated after U.S. President George Bush's disappointing rejection of binding worldwide standards on reducing the greenhouse gas carbon dioxide, adding: "Germany will not use the negative American attitude towards CO₂ reduction as an excuse to waver over the measures we have already decided to take. Germany will continue to make its contribution to protecting the climate, and will, as decided by the federal government, reduce CO₂ emissions by 25 to 30 percent by the year 2005."

Toepfer's delivery of this major statement was low key, though there is now even greater urgency and relevance in the question: Just what is Bonn after? Does the federal government intend the country to go it alone in tackling a challenge that needs to be addressed on a global scale? The answer is: yes and no. However stern Toepfer's warnings may sound, he still comes across as something of a Jeremiah. The government increasingly runs the risk of rushing headlong into a frenzy of action on an issue likely to lead to exceptional financial burdens.

It will be recalled that in November 1990, less than four weeks before the Bundestag elections, the government took the decision cited above by Toepfer with the stated intention of taking the lead in Europe, if not the West as a whole, in tackling the threat to the climate. Yet over two months before next June's UN Conference on the Environment and Development (UNCED) in Rio de Janeiro, one of whose purposes is to adopt a global agreement on the climate, it looks as if the leader may be short of followers. Not only is the United States, which is responsible for almost a quarter of CO₂ emissions and therefore bears the brunt of world criticism, refusing to be drawn; it is already becoming clear that Japan, too, is holding back.

Will the EC, though, be willing to commit itself to investing the billions required to achieve its target of stabilizing CO₂ emissions at 1990 levels by 2000? Obviously not, going by the outcome of last Tuesday's meeting of EC environment ministers, held even before Bush made his statement.

It would be as well at this point to explain the German attitude. Both the federal government and the coalition parties make much of the ambitious decision taken in November 1990; yet no one in Bonn seems unduly put out by the closely reasoned forecast published by the Economics Ministry that 12 percent is the maximum reduction feasible by the target year of 2005. They prefer to point to a Research Ministry study that suggests that a reduction "unequaled worldwide" would be achieved by building eight new nuclear power stations. However, an expansion in CO₂-free nuclear power in the present political climate in Germany is quite inconceivable.

The confusion is compounded by the fact that in December, in the wake of the unavoidable interdepartmental squabbling over the government's energy strategy, which is coordinated by Minister of the Economy Juergen W. Moelleman, the government agreed on the following strikingly evasive statement: "A 25 percent reduction in Germany's CO₂ emissions would translate into only 1 percent in terms of current worldwide anthropogenic CO₂ emissions. Going it alone nationally would, moreover, be risky for the economy as a whole. Global problems require global solutions." In other words, the 1990 cabinet decision will do almost nothing for the world climate, while it will have no uncommonly adverse effects on the already not-too-healthy economy—not to mention the fact that experts believe it cannot be implemented.

This begs the question whether Bonn's stance does not at least require clarification. It is difficult to fight for such a major objective as protecting the world climate from a position that falls between all possible stools. The federal government's first priority should be to align its position more closely on the forecasts, if it is to appear realistic and therefore credible. Though some German politicians would still like to go it alone if Germany's EC partners, not to mention the entire western world, refuse to follow its lead, the government needs to make it absolutely clear

that the country is willing to make a major effort, but only as part of a joint EC, or preferably international, campaign.

Meanwhile, the no less important debate on ways and means must be stepped up, focusing on the effectiveness of the methods to be used. Novices in these matters should be warned: Rio will be discussing the sums running into tens of billions reminiscent of previous UN conferences when appeals were made for similar sums for different purposes. Responsibility for CO₂ reduction must lie with those financing it, or it will not be effective. This much is obvious: industrialized countries with their massive energy consumption not only bear the major responsibility, but are alone in having the financial and technical resources to beat the hazards.

The German chancellor has a close personal interest in worldwide environment policy. He is hoping for success in Rio, especially as failure would overshadow "his" economic summit in July. A realistic negotiating position would hold out the best prospects for success.

Italy: Novamont To Build Vegetable-Oil Fuel Production Plant

92WS0424B Paris AFP SCIENCES in French 5 Mar 92 p 46

[Article entitled: "Novamont (Ferruzzi) to Open a New Green Fuel Plant"]

[Text] Paris—The Ferruzzi group's Italian firm Novamont announced on 2 March that it plans to build a new plant to produce fuel from vegetable oil esters "shortly." The plant will have a capacity of 100,000 metric tons a year.

"The use of vegetable oils as a raw material for fuel and combustion is becoming an agricultural, industrial, and political reality in Europe," said Mr. Claudio Rocchetta, the vice-president of Novamont, at the International Agricultural Show in Paris. France has a good chance of being selected as the site for the factory.

Novamont's star product in the niche is Diesel-Bi, which took two years of research to develop and can be made equally from rapeseed, sunflowers, or soy beans. The product is a vegetable fuel with chemical properties very similar to those of gas oil. It can be used in either pure or diluted form in diesel engines.

The Novamont group has already reached agreements in France with the metropolitan community of Dunkerque (North), whose buses now run on a 50/50 mixture of gas oil and Diesel-Bi. Other agreements are being negotiated with Dijon, Bordeaux, and Vierzon.

But there is one drawback, which some consider major: The price of fuel is "fairly high." Diesel-Bi costs from 50 centimes to 1 French franc [Fr] more per liter than gas oil, despite legislated tax concessions. Since 1 January, all biofuels in France enjoy a five-year exemption from

the TIPP (domestic petroleum products tax). In Novamont's case, only "mass" production can reduce its costs.

Stuttgart University Environmental Engineering Projects Described

Effluent Treatment System

92MI0429A Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 25 Mar 92 p 5

[Text] Scientists from Stuttgart University are showing environmental engineering research findings at the "Research and Technology Innovation Market." The Institute of Municipal Water Engineering, Water Quality, and Waste Management is exhibiting a process for purifying heavily polluted effluents and a laboratory installation for waste pyrolysis. The Stuttgart waste experts have built a novel device that converts the effluent into a thin, flowing film of liquid that is then exposed to ultraviolet radiation. The oxidizing agent used is environment-friendly hydrogen peroxide. The purification process is tremendously efficient: In most cases, toxic and nonbiodegradable substances contained in the effluent can be effectively destroyed. The technical term for it is UV-catalyzed wet oxidation in a trickle filter [Rieselfilter] reactor.

Waste Disposal by Pyrolysis

92MI0429B Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 25 Mar 92 p 5

[Text] Unlike combustion, the pyrolysis of waste justifies its existence in special applications; it is a process that requires no atmospheric oxygen. Whereas heat is released during combustion, pyrolysis involves applying heat to the material, for example by heating a container of decomposing waste from the outside. The Institute of Municipal Water Engineering, Water Quality, and Waste Management at Stuttgart University (directed by Professor Ulrich Rott) is using laboratory pyrolysis apparatus to investigate the feasibility of this type of plant and the reprocessability of the residues.

Germany: Biological 'Oil Eater' Devours Slicks

92MI0435 Wuerzburg UMWELTMAGAZIN in German No 4, Apr 92 p 68

[Article by Klaus Niehoerster: "Oil Cleared up in Record Time—New Product Has Many Uses"]

[Text] The crucial test came in mid-September of last year. In thick fog, two tankers collided on the Rhine, and three tanks of one ship, traveling downstream and laden to the brim with heavy fuel oil, were torn open. The river received an unimpeded flow of 165 tonnes of diesel.

Two hundred firefighters were immediately called in on the left bank of the Rhine between Stuerzelberg and Krefeld to deal with the 1 kilometer long oilslick. They were relying on the cleansing power of a very special

agent: They sprayed the bank area with an "oil eater" and left it to this preparation and the voracity of bacteria to clear up the consequences of the collision.

Astonishing Effect

Klaus Eiland, managing director of the Dormagen-based Sintac [Safety Technology and Environment Protection Corporation], says the enormous pollution elimination potential of "Syntan," his company's new decontaminating agent, can be unleashed "wherever work involves grease or oil, drilling or cutting oils, fuels or lubricants." The removal of oil-spills from concrete and asphalt, cleaning of grease collectors, large kitchens, deep fryers, air-conditioning systems, and even circuit boards and logic elements—the experts at Dormagen address all of these problems.

What they are using is the insatiable appetite for oil of a long-chain bioalcohol extracted from coconuts. Its action is based exclusively on "physical and biological" effects.

According to the surface cleaners, the agent is sprayed onto the contaminated area and, after only two seconds, starts to penetrate the polluted layer. The preparation distributes itself evenly and slides underneath the oil; the oil film is broken and tiny beads of oil form.

When water is added, the separate beads lose their hold and are flushed out of the ground. After a settling period, the oil can be separated off.

Even without bacteria, ventilation or other aids, "Syntan" achieves 71 percent oil degradation in water. If microorganisms are also present, the degradation rate leaps to 99.7 percent within a record time of three to eight hours—as demonstrated by the Dr. Biernath-Wuepping Institute of Water Conservation and Environmental Monitoring in Kiel. In the "oil eater," the bacteria find a nutrient medium, multiply astronomically, and convert the hydrocarbon. Luminous bacteria and daphnia (entomostracan) tests have confirmed its biological safety.

The Walter Hennige Institute of Paint Testing in Giessen applied a concentrated mixture of contaminants, comprising engine oil, gear lubricant, lubricating grease, bentonite, black iron oxide, and carbon black, to a concrete garage floor, and added the separating agent after three days. The result: After an eight-day drying period no difference could be seen between the contaminated area and the remainder of the concrete floor. The dirt had disappeared without a trace.

The innovative Dormagen company is directing particular attention toward gas stations with their overfilling problems, toward refineries, small and medium-sized metal-working and processing enterprises, and large-scale chemical works. "Syntan" avoids the need to break up concrete on the work site, a costly job, and remove it to special waste dumps. And the trump card is that work can continue while treatment is under way.

Wide Interest

Repeated treatments will remove oil that has penetrated 3 to 5 centimeters into the concrete surface. The elimination of contamination as much as 20 cm deep—this is the limit—is estimated to take some months. The Lower Water Authorities and the municipalities are showing great interest in this simple method, which can be easily used even by the layman.

The insurance companies are greatly interested in limiting widespread oil pollution, and 230 members from the insurance sector and industry have established their own research institute, the IST or Institute of Safety Research and Environmental Engineering in Dormagen, which has granted 6 million German marks to fund the development of this preparation. "It has been such a success," reports IST chief Dr. Reiner Schuette with pleasure, "that we are now able to solve almost 90 percent of all cases." In his estimation, "Sintan" is the obvious substitute for fluorinated and chlorinated hydrocarbons, which have been used hitherto as degreasers.

The product comes up against limiting factors, however, if the cleaned end product is required in a dry state. As the process is water-based, a downstream drying system, such as a hot-air fan, would have to be installed. According to Schuette: "Not every company is prepared to do this."

French Government Establishes Environmental Protection Program

92WS0435D Paris LE MONDE in French 12 Mar 92
p 12

[Article entitled: "Mrs. Cresson Establishes a New Environmental Program"]

[Text] The cabinet members who met on Wednesday, 11 March focused essentially on issues of environmental protection.

Environment Minister Brice Lalonde reported on his work, stressing from the outset that government authorities had increased their resources substantially. State and government agency expenditures on environmental protection rose to 12 billion French francs [Fr], and over Fr5 billion worth of tax concessions were granted.

Mr. Lalonde observed that a better environmental balance now existed and that the state's partners had been "mobilized." The minister also announced that a bill on regional nature parks was being drafted and that a task force would make proposals on the establishment of a "nature police" between now and 30 June.

Prime Minister Edith Cresson established a new government environmental protection program. It will involve: "Assuming the leadership of the international movement to protect the environment; guaranteeing the right of French people to a quality living environment (...); investing in the environment within the framework of

our employment and industrial policies and our reform of agricultural policy; involving citizens in environmental issues by strengthening procedures to consult the public and adding the subject to school and university programs."

As reported by government spokesman Jack Lang, the prime minister stressed that the accomplishments of Mr. Lalonde and the new environmental program "were all the more impressive as France is already one of the best conserved countries in Europe." Mrs. Cresson added that public investment in environmental protection will total about Fr100 billion in the coming years, and emphasized that "the environment must be a basic element in all the policies of every ministry."

The president of the Republic described all these developments as "very positive." He pointed out that "trees do not vote or protest" and encouraged the government to protect them. He urged it to continue its environmental work "with determination, enthusiasm, and courage, to resist all kinds of political conservatism."

Moreover, the council of ministers adopted three bills. The primary aim of the first is to modify the legal status of real-estate investment partnerships authorized to act as public savings banks; the second would approve the status of international study groups on copper, tin, and nickel. The third pertains to maternal assistants, and would involve changes in the Family and Social Assistance Codes, the Public Health Code, and the Labor Code (see page 10).

The economic and finance minister presented a decree authorizing the minting of a new Fr20 two-color coin that will picture Mont-Saint-Michel and be issued next fall.

France: Growing Market for Environmental Technology

92WS0436A Paris TECHNIQUES ET EQUIPEMENTS DE PRODUCTION in French
Feb 92, Supplement pp 66-69

[Article by Jean-Paul Meyronneinc: "The Promising Environmental Market"; first paragraph is TECHNIQUES ET EQUIPEMENTS DE PRODUCTION introduction]

[Text] Noise reduction and the treatment of air, waste water, and industrial waste are just some areas that make environmental protection seem like a booming industry. But unpredictable regulations throw manufacturers for a loop.

These days the environment is being heralded as the turn-of-the-century "eldorado," consumers and producers are thinking in terms of ecoproducts and "clean" technologies, and batteries and paints are being awarded green labels. Will mechanical industries be savvy enough to profit from the new markets, which could give them a

second wind? Though the question may make big manufacturers of pumps or filters, who have been working in the air and water treatment industries for over 40 years, smile, it is attracting the attention of small businesses. Many of them have hit bottom, and see the environmental niche as a possible lifeline.

The growth outlook for environmental markets is encouraging. According to BIPE [Office of Economic Information and Forecasting], France spent 71 billion French francs [Fr] in 1990 on protecting the environment, a category that includes anti-air pollution and anti-water pollution measures, noise reduction, waste management, and protecting the country's natural inheritance. That was a 5 percent increase over 1989. The forecasts for 1991 and 1992 are expected to be down somewhat, since economic slowdowns are never kind to investments not directly related to production. But regulatory and popular pressure have maintained a small growth rate (about 3 percent), and peaks are expected in water and air treatment. Export markets are particularly bright. The value of eastern European environmental markets, for instance, should jump from Fr80 billion in 1990 to over Fr150 billion in 2000.

Environmental Investment a Blue-Chip Value

Consequently, the market's big players—companies that integrate and supply complete installations—are resolutely optimistic. "With the growing awareness of environmental factors," says Michel Lagarde, Degremont's purchasing director, "we are obviously positioned in a booming market, which is being driven both by local communities and manufacturers." Degremont is a subsidiary of the Lyon-Dumez Water group and has nearly 50 percent of the French market for water treatment. (The other big player is OTV, a subsidiary of the General Water Company.) Degremont grew 20 percent in 1990, racking up sales of Fr2.8 billion. Growth in air treatment is just as strong. "We are growing about 5 to 6 percent annually, in a French market that is relatively stable. But export prospects are good," explains Alain Guyader, the assistant general director of Tiru. (Tiru handles industrial treatment of municipal residues, and has sales of Fr500 million.) The purchasing power of such groups is obviously substantial, and has the potential to spin off considerable subcontracting business. "Our annual purchasing bill," continues Alain Guyader, "comes to Fr200 million just for the French market. The mechanical industry is one of the main industries concerned, supplying heating equipment, gas effluent treatment, boiler construction, materials handling, and traveling cranes..." Adds Michel Lagarde, "In Europe, we purchase Fr1.3 billion in goods and services each year. We work with nearly 300 suppliers in France, a third of them in mechanical industries (fittings, boiler construction, etc.)."

The Latest Projects

Finally, besides the big contractors cited above, "polluting" manufacturers are investing increasingly in localized depolluting and waste-treatment installations. The

polluter group includes chemical, petrochemical, pharmaceutical, and even—due to substantial surface-treatment work—mechanical industries themselves. In one of the latest projects, Iridium, a subsidiary of Ausse-dat-Rey, just inaugurated a new Fr15 million purification station in its Annecy plant. The Metz electrical power plant plans to invest Fr40 million in an environmental protection system, and Pechiney will shortly install solvent incinerators in two of its factories at a cost of Fr10 million.

All this spells a bright future for some branches of the mechanical industry. And many companies have grasped the value of such markets. The first classic example is pump and pipework firms.

A Superb Reconversion

"The environment is an essential component of our strategy," explains Bernard Mutel of the communications department of Guinard-KSB Pumps, which makes effluent-disposal pumps. "We have a separate division for it, which is one of our most active." Flygt-France, Guinard's principal rival in the field, says essentially the same thing. Its marketing people explain: "The environment accounts for half our business, which generated sales of nearly Fr400 million last year." Finally, Pont-a-Mousson's market switch to water cleanup bordered on the miraculous. Its sales jumped from Fr3.4 billion in 1986 to nearly Fr4 billion in 1990, with net earnings of Fr200 million.

Another busy industry is air treatment. The dust removal (dry and moist methods) and gas-purification filter markets together weigh in at nearly Fr1.3 billion annually. And air treatment is an industry in which French suppliers, even modest-sized ones, enjoy a recognized lead despite strong German competition. Procedair—a subsidiary of the Fives-Lille group—is a small Saint-Germain-en-Laye company in Yvelines that specializes in dust removal and gas purification. Its turnover jumped from Fr56 million in 1986 to Fr97.6 million in 1990, and it has some nice references to show for it. They include the cistern gas-treatment center at Pechiney-Dunkerque, treatment of Alcoa-Australia's oven smoke at Point Henry, and more. An Arras company Oldham France, which specializes in toxic-gas detection equipment, has experienced the same bound, doubling its turnover in two years (Fr100 million in 1990). "Basically, we were making mine equipment," explains Catherine Pecout, management assistant. "But recent regulatory changes enabled us to diversify into the chemical, steelmaking, agro-food (alcohol vapors), pharmaceutical, and even telecommunications industries, where we measure the release of underground gases. As a consequence, we bring out three or four new products a year."

The Federation of Mechanical Industries (FIM) has understood the value of expanding such activities, and has decided to create a study group for ecoproducts and clean technologies. "The number of sectors that can claim the eco-equipment label is significant," says Frank

Gambelli, FIM's assistant legal director and promoter of the ecoproducts group. "Nearly a dozen of our unions are concerned, from boiler construction, to optics, materials handling, measurement instruments, and surface treatment. But it is a very recent trend, and the amount of work to be done in communications, regulations, or just plain knowledge of measurement methods is enormous."

Three Hurdles to Clear

Three hurdles—regulatory, technological, and commercial—will have to be cleared before mechanical manufacturers embrace ecology.

The first hitch is the uncertainty about regulations. The environmental market is full of booby-traps, and the classic laws of supply and demand do not apply. "Regulations, and especially the way regulations are implemented, primarily determine the volume and type of business," says Jean-Francois Vicard. Mr. Vicard is the general director of Lab, a small Lyon company specializing in dust removal and gas purification, and the president of FIM's ecoproducts group. Manufacturers who launch new industrial products are thus subject to risks that distort competition. Jacques Deleay is the assistant general director of Air Industrie Systeme, a GEC-Alsthom subsidiary that makes surface-treatment installations and autobody paint lines. "In our business," he says, "the Germans have an obvious regulatory lead, and very strict standards for solvent disposal. As a result, our German competitors can lean on an industry that is prepared to test new processes, which is not so in ours. In the long run, that may hurt us a lot."

Collective Research

The second difficulty is that environmental protection relies on sophisticated technologies. Product development requires long and costly research and development programs. "Eighty percent of our industrial fabric," adds Frank Gambelli, "is made up of small and medium businesses. That means collective research is the only way we can move ahead. CETIM [Mechanical Industries Technical Center], for instance, is conducting research on retreating cutting-oil filtrates and reducing noise."

For some small companies, the solution also lies in closer collaboration with the big names in eco-equipment. The latter are often more open than they appear. Degremont, for instance, has just signed an agreement with Pierre Gauthier Co., a small Haute-Loire company, to develop a new stop filter.

The Commercial Value

The third hurdle is the commercial value of ecological products. "In our industry," notes Henri Lefebvre, who

is the head of the engineering and design department of Maco-Meudon, a leading French producer of scaling hammers, "noise and vibrations are still seen as proofs of quality and solidity. And for now, quietness is not a key selling point." It will not be easy to promote the environmental approach, for it is not at all clear why equipment suppliers should play the green card. They are not in the same position as detergent manufacturers or packaging companies, whose products are sold directly to consumers. "Yet there are two reasons why we should," concludes Jean-Francois Vicard. "One, we will increasingly be called on to supply non-polluting equipment, and especially to keep track of how users employ it. We can play a leading role, for we are at the front end of the production chain. Finally, the very image of the mechanics industry is at stake. Young people, for instance, may find it interesting and motivating to see that our industry is among the most active in protecting the environment." All that is left is to convince the industry itself.

Cleanup: A Fr10 Billion Market

The Principal Environmental Markets

	1990 Sales (in millions of Fr)	Expected Growth Rate	
		in 1991	in 1992
Cleanup (1)	10,178	-1.5	+3
Sound and heat insulation (2)	2,280	-0.5	+1
Purification sta- tions (3)	1,020	+10	+12
Duct systems	811	-1.6	+0.3
Dust removal equipment	770	-10	+3
Filters	500	+6	+5
Water measure- ment instruments	320	+0.5	+6
Sewage pumps	265	-0.5	+5
Environmental engineering in France	250	+4	+11.5
Environmental engineering for export	230	+4.3	+8.3
Air measurement instruments	205	+2	+5
Incineration installation	185	+4	+3

The highest sales growth rates are expected in purification stations, a market worth about Fr1,250 million this year.

(1) including civil engineering (2) including production of insulating mineral fibers (3) excluding civil engineering.

Germany, the European Leader

Number of companies working in eco-industries by country

	Number of companies	The big companies
Germany	4,000	Deutsche Babcock, Siemens, Lurgi
Italy	2,300	Acqua
France	1,500	Lyonnaise des Eaux (+Degremont), CGE (+OTV), SAUR (Bouygues)
Great Britain	1,500	WS Atkins, Thames Water, Biffe

Germany: Viability of Alternative Energies Reviewed

92MI0437 Wuerzburg *UMWELTMAGAZIN*
in German No 4 Apr 92 pp 118-119

[Article by Elke Ditterich: "Which Technology is Feasible? It All Comes Down to Cost"]

[Text] By the year 2005, the production of carbon dioxide (CO₂) in Germany is to be reduced by 25 to 30 percent (in relation to 1987). This target for trade and industry, administration, and the consumer was approved by the federal government in the middle of the year before last. This exemplary measure is intended to contribute to counteracting the climate-threatening greenhouse effect. However, the target can be met only if the consumption of fossil energy sources is significantly reduced. This can be achieved both by saving energy and by making greater use of renewable energy sources.

Effective Combined Processes

Everyone—industry, small businesses, and the domestic consumer alike—must save energy, but even power stations can play their part by using combustible fuels effectively in power generation. Over the last 20 years, modern technology has considerably increased the efficiency of power stations; the development of suitable combined processes has already made for over 50 percent efficiency. Various methods have proved useful for more effective fuel consumption, for example:

- Combined heat and power generation applied in district heating systems (the heat given off during electricity generation is used for heating purposes by piping steam out of the turbine);
- Combined power stations (a gas turbine is installed upstream of the conventional steam power station, the exhaust gases from the gas turbine process serving as preheated combustion air for the steam power process);
- Gas and steam power stations (where only the combustion chamber of the gas turbine is fired; the hot waste gases generate steam for the steam power process via a heat exchanger).

The use of renewable energy sources, such as water, wind, solar energy, renewable raw materials, the heat of the earth's interior, or gas from waste dumps, as additional means of saving CO₂ will have to be further increased in the future. They contributed only 2 to 3 percent to primary energy supplies in the old German laender before unification. According to statistics from the Association of German Electricity Companies, renewable energies accounted for approximately 4 percent of the electricity generated in western Germany in 1990, hydroelectric power making by far the greatest contribution.

In the estimation of the states party to the WEC (14th World Energy Conference in Montreal, 1989), the renewable energy sources will still be dominated by hydroelectric power in the year 2020, whereas the prospects for solar and wind power are viewed pessimistically. It is forecast that the renewable energies will not exceed 10 percent of the total energy supply in 2020. Although renewable energies have considerable technical potential, their state of development must still be described as "embryonic."

A study carried out jointly by the German Institute of Economic Research and the Fraunhofer Institute of Systems Engineering and Innovation Research on behalf of the Federal Ministry of Research and Technology (BMFT) addressed the economic prospects for renewable energy sources. It was not possible to include the new German laender in the survey; however, their inclusion would not have led to a more favorable assessment of the renewable energy sources' prospects of success. The results of the study are illustrated in brief below:

Cost Reduction Foreseeable

—Solar Energy: Because of the low level of sunshine in the Federal Republic of Germany, the use of solar collectors is largely restricted to low-temperature heating, e.g., domestic water heating, space heating, or swimming pools. In the main, solar systems are not yet competitive for the first two of these applications, but markets may soon open up for space heating by solar-supported local heating systems.

In some cases, solar collector systems for swimming pools have already achieved economic viability. Both R&D work on potential cost reductions and demonstration projects are urgently needed.

Solar drying plants in agriculture have already proved economically viable, being cheaper than oil- or gas-fired hot air systems.

Solar heat power stations are virtually a nonstarter for the Federal Republic of Germany, but in areas that get a

lot of sunshine, solar farms with channel collectors have proved commercially viable.

Photovoltaic systems based on crystalline and amorphous silicon require considerable further technical development before greater efficiencies and lower costs can be achieved. This method is mainly used to produce small-scale devices, such as calculator, watches, and off-net communications systems. Photovoltaic power stations must still be considered one of the most costly power generation systems. Grid-connected systems, for example, still cost around 10 times too much. However, major cost reductions can be anticipated in this area in the future.

—**Wind Power:** Measured in terms of the refunds payable for electricity input into the grid, small wind farms are already competitive, and medium-sized ones almost so. A further drop in construction costs, as has happened in Denmark, would provide the prerequisites for economical operation of small and medium-scale wind farms in the 90s. Even large-scale farms will increasingly start to pay their way. Efforts should be made to lay down uniform conservation, environmental protection, and type approval guidelines.

—**Hydroelectric Power:** Hydroelectric power stations have already reached a high technical level, and there will be virtually no further significant development in this area. Model calculations predict that smaller hydroelectric power stations will be profitable, and there is potential in the reactivation of decommissioned plant and the modernization of existing power stations.

—**Renewable Raw Materials:** The cultivation and combustion of renewable raw materials such as napier grass still requires much research work. In Denmark and Norway, fairly large plants that burn straw and wood chippings are in operation, and functioning well. Exact figures regarding the plants of this type installed in Germany are not available. Whereas the high cost of supplying them with straw makes it unlikely that straw-burning systems will be economically viable, the wood-burning systems, which are admittedly not yet competitive, will become economical in the future as soon as oil prices rise even slightly. The potential for renewable raw materials is limited, however, by the total area available for cultivation.

—**Gas From Refuse Dumps and Biogas:** Despite increasing consumption, their contribution to power supplies will remain low in Germany. Without subsidies or concessions, biogas plants are scarcely economical at present; only rising energy prices could ever make them competitive. Moreover, insufficient experience has been acquired to date to draw conclusions as to any problems that might arise in long-term operation.

—**Geothermal Power:** California, Mexico, Japan, and Italy are the main areas that exploit geothermal

sources in the form of hot water or steam from the depths of the earth. Tectonically active regions, in which the magma extends to just below the earth's surface, are particularly suitable. Depending on the temperature, the water or steam can be used for heating or for electricity generation. In Germany, exploitation of geothermal heat is not widespread, although exploitable water-bearing strata would be available in the northern German lowland plain, the southern German Molasse basin between the Danube and the Alps, and in the rift valley of the Upper Rhine. Eastern Germany, too, presents favorable conditions, especially as extensive district heating networks exist there. Since no fuel costs are involved in exploiting geothermal heat, although the drilling involves high investment costs, the economic viability of this method is difficult to assess.

To sum up, it can be stated that only a few renewable energy sources can currently be exploited economically. Without high additional subsidies, their potential for use will remain low in the next 20 years. Pricing policy measures, subsidies, and tax concessions designed to promote the expansion of existing renewable energy technologies should therefore be the aim.

France Plans Nuclear Plant Monitoring System

92WS0446B Paris L'USINE NOUVELLE in French
12 Mar 92 p 25

[Article by Patrick Levy: "Radioactive Gases To Be Monitored Very Closely"—first paragraph is L'USINE NOUVELLE introduction]

[Text] A computerized system linked to sensors should help deal with the consequences of accidental emissions of radioactive gases from French nuclear plants.

It is exactly the sort of application one prays will never have to be used. EDF [French Power Company] hopes that installation of the G3E (Management of Effluents and Environment) system will ensure that if a Chernobyl-type accident should ever happen in France, it will not have the catastrophic effects seen six years ago in central Ukraine.

Next summer the Cruas plant in the Rhone will be equipped with G3E. After two or three months of performance studies there, the system will be installed at the 16 other French nuclear plants operated by EDF. At the rate of three sites every two months, G3E will be fully operational by the end of 1993. The system represents an investment of 24 million French francs [Fr].

What exactly is G3E? It is a computerized system linked to sensors that are already operating in the plants, and its purpose is to perform real-time integration of data pertaining to the consequences of radioactive gas effluents released in an accident. Accurate gauging of the effects also requires detailed information on meteorological conditions at the moment of the accident. That is

why G3E is permanently tied in to Meteofrance computers, through a computer at the National Crisis Center. Based on DPX/2 Unix work stations manufactured by Bull, the systems are linked to on-site devices (sonars, mast poles, sensitive weather-vanes) that allow each plant to measure wind speed and direction. For better utilization of the equipment, lead contractor Syseca has equipped the stations with graphics display screens. The system is controlled by customized software that integrates the data with mathematical models of diffusion. Ease of use is ensured by Motif and X-Windows type graphical interfaces. The resulting information, transmitted to prefectural authorities, could be an invaluable decision-making tool in event of a crisis.

On the drawing boards for quite some time, the project was put on the fast track after the Chernobyl catastrophe. But this apparatus is designed to function in a quite different environment. The reactor containment structures used in Europe and the United States, unlike Soviet nuclear plants, are designed to keep as much contaminated matter as possible inside the reactor vessel. When contaminated matter threatens to escape through fissures, it is sucked up into the reactor ventilation shaft. This allows it to be "tracked" more easily. This design characteristic is what made the installation of G3E at French nuclear facilities feasible.

French Industry Leaders Form Environment Group

92WS0447B Paris AFP SCIENCES in French
19 Mar 92 pp 40, 41

[Unattributed article: "Creation of the 'Business for the Environment' Association"]

[Text] Paris—Fourteen large industrial groups have just created Business for the Environment, a French association designed to promote their joint efforts for the environment, and also to defend their point of view; the creation was announced on 17 March by the president of the Association, Mr. Jean-Rene Fourtou, Rhone-Poulenc chief executive officer.

The Association, created within only six weeks, includes—in addition to Rhone-Poulenc: Air Liquide, Generale des Eaux, Elf-Aquitaine, EDF [French Electricity Company], EMC [Mining and Chemical Company], Hydro-Azote, Lafarge-Coppe, Lyonnaise des Eaux-Dumez, Pechiney, Renault, Total, Usinor-Sacilor, and the Belgian company Solvay.

It has a starting budget of 17 million francs [Fr], voluntarily contributed by the founders, and it may receive specific contributions to implement its programs. In particular, the budget will be spent on eliminating "orphan blackspots," in other words abandoned industrial-waste sites, Mr. Fourtou indicated.

The latter objective complies with the government's request: at the end of January, at a Ministers Council, the government gave companies two months to sign an

industrial waste agreement with the Agency for Environment and Energy Control (ADEME), Vincent Denby-Wilkes, the ADEME general manager, explained.

The ADEME and Business for the Environment are currently negotiating the amount of the manufacturers' contributions to solve this problem. An agreement would exempt companies, even non-members, from the new tax on waste, for which a bill will be introduced in Parliament during the spring session, he added.

The agreement with the ADEME should be signed "this week or next week," Mr. Denby-Wilkes said, adding that the objective is to have Fr40 million per year for five years, only part of which will be provided by companies.

The founding companies, most of which operate in high-pollution sectors, already spend over Fr10 billion per year on the environment, Mr. Fourtou recalled. He also emphasized that the Association intended to act as a lobby with French and European authorities, especially in preparing environmental standards and legislation. Mr. Jean Monod, the Lyonnaise-Dumez CEO, pointed out "the dangers of allowing EEC or GATT administrations to regulate without giving business a say in the matter."

The Association aims to increase the number of its founding members, "within three months," and to recruit as many members as possible in all French companies. For this, it is considering setting a lower membership fee for small and mid-size companies—the current fee is Fr100,000.

The Association vice-presidents are the Lafarge-Coppee CEO, Mr. Bernard Colomb, the Renault CEO, Mr. Raymond Levy, the Usinor-Sacilor CEO, Mr. Francis Merand, and Mr. Michel Pecqueur, chairman of the CNPF [National Council of French Employers] environment commission.

German Chemical Industry Adopts Environmental Protection Plan

92WS0491B Duesseldorf VDI NACHRICHTEN
in German 27 Mar 92 p 27

[Article by Ursula Schiele-Trauth: "Chemical Industry Prefers Process-Integrated Environmental Protection"]

[Text] VDI-N, Bonn, 27 Mar 92—Even when the German chemical industry refused a leading role in the Federal Environmental Ministry's planned waste turn-in program, as it did in Bonn in mid-March at a professional meeting of IG Chemie-Papier-Keramik, the industry is still on the way toward the development of an environment-friendly process. It is called production-integrated environmental protection because it is based on the reasoning that if leftover materials were not generated in the first place, they would never have to be disposed of at all. In the long-term, this concept should—in the economic sense—eventually outstrip the currently

used "additive environmental protection measures," which are becoming increasingly more expensive.

To date, emphasis in environmental protection has been put on processes that are initiated after the actual production processes have finished. Sewage treatment plants, waste-air scrubbers, or heat treatment of wastes characterize this "end of the pipe" strategy. The Institute of German Industry and Commerce in Cologne has summed up the results achieved as follows: Even though production in the chemical industry has risen 200 percent since 1965, air contamination during the same period has been reduced by two-thirds, and the sewage load has been reduced by 90 percent.

But there has been a price to pay for this kind of environmental protection. For example, in 1990 the chemical companies in former West Germany had to lay out about 6.4 billion German marks [DM] for the operation of environmental protection facilities, i.e., an amount of more than DM17 million a day. A year earlier in 1989 the "daily going rate" was just DM14 million. Sewage purification alone consumes almost half of this amount, while another one-fourth goes to waste removal and air protection. Recently, at an environment symposium in Leverkusen, the head of Bayer company, Hermann J. Strenger, estimated that of the totality of investments "every sixth DM goes to environmental protection."

In the face of constantly increasing limiting values, this "additive environment protection" is already impacting its economic limits. As Dr. Dieter Becher of Bayer puts it: "Further improvements can only be made with exponentially increasing costs, and in the final analysis these procedures are only treating the symptoms." They do not conserve raw materials, but rather merely make leftover waste more environment-friendly by expending further raw materials and power resources. The fact that additional costs are constantly occurring is reason enough to search for an even more environment-friendly production-related method of eliminating waste. In this way, Becher believes "perhaps production could be kept at a constant level or, with a little luck, even reduced." The production of the mass plastic polypropylene (PP) is an example, where environment protection was forced to find a better process. For a decade, polymerization was carried out in a light, volatile solvent. This resulted in substantial air pollution, particularly during the separation and drying of the plastic. In order to satisfy the clean air requirements, the exhaust air would have to be led off through large adsorption towers. "It was technically possible to do this," according to Professor Guenter Lipphardt of Hoechst AG, "but simply too expensive." To process polypropylene this way would make it too expensive to sell.

Meanwhile, it has become possible to polymerize this plastic under pressure without a solvent. Before this can be done, however, new, highly effective catalysts had to be developed. According to Lipphardt, for years it had been assumed that they could not be developed.

Now, in new facilities in Huerth, Hoechst uses a catalyst system to polymerize propylene into the plastic polypropylene (PP). The production facilities of this, the second largest West European PP producer, can be operated with minimal sewage, exhaust air, and noise emissions, and still meet all the requirements for the protection of the environment.

In many cases, even today the effectiveness of catalysts is not thoroughly known. Their further development, therefore, may yield a great innovation potential. Just by means of greater recovery and improved selectivity, fewer by-products, which would later have to be removed, would develop in many reactions. The chemical industry today is constantly seeking to find ways of re-using auxiliary agents like acids, catalysts, and organic solvents, but the cost of such recycled products often exceeds that of a new product.

Likewise, the attempts to utilize leftover materials, which previously were just considered waste, proceed. One example is sulfur made from flue gases. In many power plants, the sulfur dioxide is washed out with lime milk. Using this additive method, BASF in Ludwigshafen could obtain 35,000 t of gypsum a year, which, however would be difficult to market. Instead, the plant developed an adsorption method for the sulfur dioxide and then converts it into sulfuric acid, which is used as a key chemical in many processes.

"This is a model example of what can be achieved with a 100-year-old product," exclaims Becher of the Bayer company about the intermediate product dye H-acid. In the past, the long synthesis chain of this naphthalene derivative was divided among several Leverkusen companies and accompanied through the many intermediate separations solely by considerable amounts of sewage and waste. In a new plant, this important product is now synthesized in an entirely different way.

The environment-related success balance sheet can be seen in terms of less use of raw materials, less amounts of sewage, and less solid waste for disposal. The improvements in processing still do not suffice to compensate for the additional costs incurred from new plant construction and new facilities. H-acid from India or China, produced in the old way, is still offered on the European market "at prices that in some cases are less than our production costs," Becher asserts. In the case of other intermediate product dyes, where similar improved processing techniques have been developed, the competitive situation was even worse, causing production to shut down in Germany. "That is a very bitter pill that does little to inspire work on a production-integrated environment-protection technique."

The restructuring of the processes requires a good amount of investment capital and is a tedious task in that each individual process has to be examined separately. And even in cases where a solution more friendly to the environment has been found, it usually takes about another five years to win official approval in

Germany—much longer than in other countries. Meanwhile, Buechel makes the criticism, "increasingly stricter environmental protection laws are forcing the industry to make short-term decisions, use additive measures, which in the final analysis drain resources away from integrated solutions of the problem."

In the chemical industry, optimizing energy by power-heat coupling has a long tradition. After being released, the steam generated in the power plant's high-pressure boilers goes to the turbines in the plants, where it is used as process steam. The approximately 40 percent energy utilization from normal thermal power plants can be increased in this way to 90 percent.

For chemical production processes, power is an essential factor. Only power can put the reactions in motion, and power is also required to separate the substances that are produced either by distillation or rectification. The "pinch technology," developed by Professor Bodo Linnhoff of Manchester University is a recent innovative technique to conserve power. The basic principle of this technique is that Linnhoff first identifies and secures all the currents of a chemical process that give off heat, be it residual heat from reactions, heat from exothermic processes, or heat from the combustion of residual materials, and then links them to the processes requiring heat.

With very few controls, Linnhoff has constructed a thermodynamically protected network, from which the engineer can read the minimal heating and cooling requirements very precisely. The analysis also shows the optimal temperatures at which heating or cooling energy should be introduced and permits an estimate to be made of the capital investment costs of the heat exchanger net. In this way, in the case of new or replanning, the most favorable variants of a process with respect to energy conservation can be identified in advance.

"In reality, there are about 30 to 50 currents to be observed in a chemical production process," Dr. Walter Lenz, a BASF energy expert explains. In this company, planning for the most efficient utilization of process energy gained very early acceptance. Despite an approximately 60 percent increase in production since 1970, the consumption of primary energy to generate steam and current was reduced by more than 50 percent.

Germany To Subsidize Purchases of Renewable Energy Cars

92WS0499C London *INTERNATIONAL MANAGEMENT* in English Mar 92 pp 22-23

[Text] The North Rhine-Westphalia (NR-W) state government has announced a grant of up to DM10,000 (ECU4,896) for people wishing to buy electric cars—but on one condition. The electricity for the car must come from either wind or solar energy. Anyone who owns or has shares in a wind plant or a photovoltaic collector qualifies for the grant, as long as they live in the state.

The initiative features in a government drive to reduce carbon dioxide emissions.

The electric car grant is part of NR-W's renewable energy support and development programme, REN. Wind power in the region receives a level of support unique in Germany. The state tops up federal support to 75 percent of wind project investment costs—in some cases up to 100 percent.

Even so, wind harvesting in the land-locked region will never be as widespread as in the northern coastal areas. Lower Saxony has plans to install 1,000 megawatts of wind power by 2000. Currently, the whole of Germany hosts 654 wind turbines with total installed capacity of 90.4 megawatts.

To qualify for the new grant the cars must seat at least two people, have a minimum speed of 15 kph and a range of 60 kilometres at 50 kph. The new Flitzers are neither easy nor cheap to come by. Volkswagen recently produced an electric version of its popular Golf. But it sold at DM70,000 and only 70 were produced. Opel says it has a car ready for serial production, but sources say the price is 'likely to put off even the most dedicated environmentalist.'

Meanwhile, the North Rhine-Westphalia government says it has already received 'some' grant applications even though, according to an industry spokesman, no suitable car is yet available.

FACTORY AUTOMATION, ROBOTICS

EUREKA Project on 'Total Maintenance' Launched

92BR0276 Paris *ELECTRONIQUE INTERNATIONAL* HEBDO in French 12 Mar 92 p 12

[Article signed J.M.: "A EUREKA Program That Is Open to the Electronics Industry"]

[Text] The EUREKA Secretariat has just launched a program that focuses on the subject of the operational availability of production equipment.

All manufacturers are now aware of it: Operational availability of production equipment has become a key element in the competitive position of their companies. In the face of the Japanese who have had "total maintenance" procedures for many years, the Europeans have a certain gap to fill in this field. In order to help them achieve their projects, the EUREKA Secretariat has decided to launch the MAINE (Maintaining Availability in Europe) program whose major goal is to reduce the causes of stoppage or non-utilization of production systems. It was launched officially today in the framework of the Maintenance Rhone-Alpes fair held in Lyon. "We have already received a few files that are currently being examined. But none of them concerns directly the area of electronics. However, the production equipment of electronic systems is subject to the same dilemmas as the

equipment in other fields. Proposals from manufacturers in this sector will therefore be welcome," indicated Gilbert Liegeois, the national coordinator of the MAINE project.

Maintenance Comes to 4.2 Percent of a Company's Turnover

Maintenance is costly. It is estimated to amount to an average of 4.2 percent of turnover of a manufacturing company. This shows how important the MAINE project is. It intends not only to improve the competitiveness of existing products and processes, but also to start conquering new markets. There are numerous associated topics of R&D: integration of maintenance in the entire service life of equipment, not only in their operating phase; integration of maintenance and quality, because the quality of parts or subassemblies depends directly on the characteristics of the equipment that manufactures them; integration of maintenance and safety in the social field as well as in the field of environmental protection. In the past, projects linked to maintenance have already been created within the EUREKA framework. An example is the Fiabex project, which was initiated by the French company CEP [Control and Prevention Systems] in cooperation with three European partners (in Italy, Spain, and the UK). This is a line of tools to help in analytical forecasts of operating safety and in operational diagnostics of industrial systems. A Fiabex application is in progress in the field of analog and digital electronics.

A project receives the European EUREKA label if it is conducted jointly by at least two companies from different countries. Up to 35 percent of its reimbursable funding may be paid by the European authorities.

Germany: BMFT-Funded Automation R&D Programs Reported

CIM for Small Businesses

92MI0394A Bonn BMFT JOURNAL in German Feb 92 p 2

[Text] Since 1 January 1992, the BMFT [Federal Ministry of Research and Technology] has been funding the use of computer-integrated manufacturing (CIM) in small and medium-sized businesses in the new federal laender, for which purpose it has allocated a total of 100 million German marks [DM] over a period of four years. Besides this, a further DM20 million has been granted by the BMFT for the establishment and operation of five CIM technology transfer centers in Chemnitz, Dresden, Magdeburg, Suhl, and Wismar.

The companies in the new federal laender face the need to modernize their manufacturing systems. The producers of machine tools and tools, textile machines, agricultural machinery, timber processing machines, printing presses and paper-making machines, building and building material machines see CIM as a necessity for achieving competitiveness.

The new funding measures are designed primarily to help small and medium-sized companies to introduce or expand CIM methods quickly. Funding focuses on the production technology suppliers, as mechanical engineering products have a crucial effect on productivity and quality in all other fields.

This funding revives a measure that had already been completed in the old federal laender and from which 1,200 companies have benefited.

Applied Microelectronics Research

92MI0394B Bonn BMFT JOURNAL in German Feb 92 p 13

[Text] Together with the Lower Saxony Ministry of Trade, Technology, and Transport and the Hamburg finance authorities, the BMFT [Federal Ministry of Research and Technology] is financing the Northern German Association for the Promotion of Microelectronics Applications. It is made up of SIKAN [Silicon Application and CAD/CAT Lower Saxony] in Hannover, the IAM [Institute of Applied Microelectronics], in Braunschweig, and the MAZ [Microelectronics Application Center] in Hamburg. This association will create an infrastructure that will draw together and strengthen R&D capabilities, such as those available in nearby colleges, and link them into a network with industrial microelectronics users. The association's main purpose is to provide advanced engineering and other technical services of a kind not adequately available on the market.

This will promote the use of microelectronics, especially in medium-sized companies, as joint projects can be carried out to industrial standards.

German Institute Develops Multi-Robot Assembly System

92WS0417A Duesseldorf VDI-Z in German Mar 92 pp 18-19

["Cooperating Multi-Robot System"]

[Text] Among the research and development projects of the Fraunhofer Institute for Production Engineering and Automation [IPA], a highly flexible assembly cell, called MAX [Modular Assembly Example], consisting of five industrial robots, has been developed, in which chaotically controlled, product-neutral work can be conducted. The conversion of the offline-programming into overlapping working areas and the possible redundancy in material and tool flow facilitates innovative strategies for assembly control and failure management.

Of the five different industrial robots from various manufacturers, one is employed as the working stock robot. This mobile robot, suspended from a portal, can attend to both material flow as well as tool-handling jobs. All robots are equipped with the same tool change flange, so that in the event of the failure of one of the robots the industrial robot can take over its jobs. It can also be used

for "hand-in-hand" assembly. New joining technologies can be carried out on this assembly system as, for example, through joining on a unit carrier, the complete assembly of a wing cell pump (including pressing bearings to shafts), the assembly of a valve module, and the assembly of a pneumatic cylinder valve module on which screw fittings have been installed and hoses attached.

The installation has not been designed for economic mass production, but rather for variants and as a test carrier in order to test and introduce the most diverse technologies and tools developed in cooperation with industrial partners. Also involved in this process is the solution to questions related to quality, for which, for example, a video system is useful. Each of the component cells can be run autonomously by its own PC. For cooperative operation, another PC, acting as cell computer, superimposes the autonomous computers. When, for example, "get screws" may be the program command for the individual industrial robots, "install pump" may be the program for the control station. In order to get away from the formulation of the prevailing plans and controls followed for years, this installation is chaotically controlled ("first come, first served"), in which a short-term simulating module ensures that ongoing work steps do not cause undue and uncalled-for interference with other work procedures, but, instead, that an alternative strategy is developed for such a situation.

The entire installation has been reproduced kinematically and kinetically in a CAD model. The pass-through capability is demonstrated as follows.

For a visitor signature working on a PC, a point and a path code is created, which is then translated into the robot program language and sent by the cell computer to the robots via fiberglass. As soon as the summary of jobs, the installation status, and palette control appears on the cell computer, the start command for the job submitted is given. Immediately thereafter, the redundant industrial robot seizes a write head and writes the visitor signature on the wall. In this way it is demonstrated that, thanks to the coordinated and reciprocally safeguarded control mechanism, an entirely unknown and unplanned job can be entered in the installation without a crash.

The question as to whether the main point of interest in practice lies more with the technologies of the subcells or more with the interplay of the subcells is answered by engineer Ralf Guenther Grau as follows: "We are of the opinion that such turn-key installations make sense, because they are capable of bypassing disruptions, which otherwise would bring the installation to a halt, by integrating a single industrial robot into an existing system with perhaps four robots. These installations can utilize working areas and monitor any operating mode, be it autonomous, hand-in-hand, or the replacement work, in the event of a failure."

"In this way, installation availability can be achieved that would not be possible through conventional means. In addition, we have achieved—by incorporating our

simulation environment—a degree of integration, and pass-through capability, and a conclusiveness such as is almost impossible to find in industry today. From the CAD model directly to the coordinating control, directly to the robots, directly into operation. We control chaotically, but we also monitor closely. We do not monitor chaotically.

German Industry Leader Predicts Improved Robots at Lower Costs

92WS0429A Duesseldorf *HANDELSBLATT* in German
20-21 Mar 92 p 20

[Article by HSN: "Improved Technology at a Considerably Lower Price"]

[Text]

GMFanuc Robotics/Searching for New Customers

The need for robot applications will continue to grow in the future. Gunter E. Herr is convinced of this. He is the managing director of GMFanuc Robotics Deutschland GmbH in Erkrath. Improved technology at a slightly lower price will expand the market base for robot systems. For this reason, the German sales subsidiary of GMFanuc Robotics Europe GmbH, also located in Erkrath, will turn greater attention to customers outside the automotive industry.

Gunter Herr sees new areas of application for robot systems primarily in metal processing, sheet welding, deburring, feeding presses and forging units and handling workpieces and dies on machine tools. "Two, three years ago, robot systems for sheet welding cost about 220,000 German marks. Today they are available with somewhat fewer features for about 120,000 German marks," observers Herr.

The main reason for this decrease in price is that manufacturers have moved toward low-cost solutions. They have saved money particularly in peripheral equipment. The price drop for robots themselves in recent years has not been so dramatic. GMFanuc has reduced its prices in the last year by less than 20 percent. In total, the company installed about 250 systems in Germany last year and achieved sales of about 95 million German marks (12 percent more than the previous year).

Germany is the largest market for GMFanuc Robotics Europe with a share of about 36 percent of the units sold in Europe (700 systems in 1991). The robots come from Fanuc Ltd. in Japan except for the devices for painting and laser technology. The company produces about 450 robot systems monthly in a highly automated manufacturing system there. These robot systems are sold worldwide.

Fanuc is today one of the leading manufacturers of CNC [computerized numerical control] control technology. The area of robot technology in the company also profits from this know-how. To use the automation equipment

as flexibly as possible, it must be easily programmable for other operating tasks. The company will introduce a new control generation designated "RJ" at the Hannover Fair at the beginning of April. These controls not only make robots more powerful, they also allow users to program the robots, a feature that had little to do with this technology until now. Special software programs within the control system and written for specific applications form the basis for this facility.

Germany: Institutes Urge Adoption of New Manufacturing Technologies

92WS0442A Duesseldorf *HANDELSBLATT* in German
26 Mar 92 p 26

[Article by Peter Heckenjann: "Partial Solutions Must be Combined into One Homogenous Whole"]

[Text]

Manufacturing Technology/Achieving a Competitive Advantage With New Technologies

The production concept of the future for the Federal Republic of Germany must have "control of multi-version production with maximum quality and short delivery times at appropriate costs" as a goal. Implementing future-oriented technology ideas and introducing new technologies are important tasks for companies and help secure future success.

Japanese companies did not achieve their leading position in rational production by comprehensive computer integration or consistent use of high technology. Rather, they obtained it primarily through a uniform application of the cost-effective control of all production processes.

The application required in the future for uniform production modeling must encompass product function, the production process, technical control and logistical processes. Some of these models already exist. It is important to combine these existing partial models to form a homogenous whole. In doing so, the entire production sequence must be linked with a pervasive quality assurance and uncompromising time and cost control for all operations.

In many countries, labor costs represent the largest share of the cost in industrial production. More than all other cost factors, they decide the competitiveness of a factory. However, high labor or wage costs can be handled without damaging international competitiveness if these costs, in real economic terms, are secured by a correspondingly high productivity. One path in this direction is the use of new technologies as potential means of rationalization.

The ASI [Adaptation, Substitution, and Integration] method is one strategy for developing and converting new production technologies. Examples of these methods are the following:

- Near-net-shape machining of turned parts is possible with high dimensional precision if the forging is cooled from the forging heat under controlled conditions. An additional machining step favorably affects the following machining processes (adaption).
- Precision turning machining of hardened components using advanced cutting materials: Time-intensive and costly grinding is replaced while also providing better surface quality (substitution).
- Rotary milling or using lasers on a lathe for local hardening of a turned part followed by hardened rotary machining: Several steps are integrated onto one machine.

Product Optimization Through Surface Machining

The rapid prototyping method allows quick creative forming of models based on CAD data. In this method, the times from design to a finished model can be dramatically reduced.

One example is the application of selective laser sintering (SLS) for producing time-critical models in the product development of electric tools. Contrasted with conventional milling of die-casting dies for formed parts or housings, considerable time and cost savings are achieved.

The stereolithography method (STL) is used to keep up with the production cycles in the automotive industry. These cycles are becoming shorter and shorter. Application areas, for example, are in the design area to produce visual-aid models, in construction to find defects in complex surface models, and in prototype manufacturing.

Increasing demands, in terms of mass, strength, and performance in service, on sheet-metal parts require new materials and forming technologies. The tailored blanking technology processes blanks that have been tailored according to the stresses. These blanks are composed of individual blank pieces of different materials, material thicknesses, strengths or surface coatings, welded together and then deep-drawn. This creates components that can withstand the stresses. The properties of these components are optimized for the later application of the finished part. Cost savings in the process and a reduction in the amount of material used can be achieved. Reducing the weight of load-bearing structures increasingly calls for the use of higher-strength sheet metal. Bake-hardening technology uses sheet metal having a final strength not established until after forming. For this "hardening process," the deep-drawn parts are "baked" in an oven at low temperatures. This usually takes place in parallel with stoving coats of paint on parts that are completely formed and painted. By combining the two process steps, it is possible to obtain better properties for the finished parts with low additional costs for the process and material.

More and more, the area of cutting processes machines highly complex contours with the flexible tools of laser beams and water jets. High-performance Nd:Yag solid-state lasers, combined with light-pipe technology and

robotics, allow cutting operations on any three-dimensional geometry. Manufacturing such parts is not possible or only possible under certain circumstances using conventional methods. While this technology has already become state-of-the-art in Japan, it is still in the introductory phase in Europe.

Laser-beam recasting of cam shafts to increase wear resistance is a new technology that replaces existing methods. Wear tests on an engine test stand and economic appraisals have shown that the new method can be used at a lower cost than the conventional technique.

The initiative to introduce the Lasertex method for the surface treatment of thin steel sheet arose primarily from the necessity of securing market share and a positive image for the future. Sheet metal treated with laser-textured rollers exhibits better qualities in terms of paint gloss and deep-drawing ability than conventionally produced sheet. Although, in general, a higher price is not achieved for this increase in quality, a competitive advantage is created. In turn, this advantage forms the basis for increasing or securing market share.

In view of the increasing importance of the innovative manufacturing technologies for companies described here, an intensive exchange of experience between current and future users, vendors and research institutes is necessary. The Laser Zentrum Hannover e. V. (Laser Center of Hanover Incorporated Association (LZH)), the CIM-Fabrik Hannover GmbH (CIM Factory of Hannover Limited Liability Corporation (CFH)), and the Institute for Manufacturing Technology and Cutting Machine Tools (IFW) are sponsoring a symposium on 28-29 April 1992 in cooperation with the Gesellschaft für Management und Technologie (Society for Management and Technology (gmft)) under the title "New Technologies as a Competitive Strategy." Such important contacts can be made at this symposium. The conference will take place at the Congress Zentrum Hanover.

France: High-Speed Machining Techniques Developed

Status of Technology

92WS0445A Paris *TECHNIQUES & EQUIPEMENTS DE PRODUCTION* in French Feb 92 Supplement pp 61-62

[Article by Alexandra Schuerder: "Very-High-Speed [VHS] Machining: At the Experimental Stage"—first paragraph is *TECHNIQUES & EQUIPEMENTS DE PRODUCTION* introduction]

[Text] Still waiting for VHS machining, European manufacturers and users try to outdo one another in secrecy at a time when the Japanese are beginning to gain a foothold on the market.

Shorter cutting times, improved productivity, elimination of under-speed machining and semi-finishing, and finally reduced overall machining costs: on paper, VHS

machining looks great. Yet, it is slow in emerging from design and engineering departments. For the moment, its few industrial applications are still confined to large companies (Renault, SNECMA [National Company for Aircraft Engine Study and Manufacturing], etc.) and hardly go beyond the experimental stage. Worldwide, machine manufacturers are reluctant to venture in this subsector, with the notable exception of the Japanese. In France, Realmecca alone has made a full commitment to it. This is because manufacturers estimate that a VHS machine will cost 20 to 30 percent more than a traditional machine. The tool holder and the cutting tool, too, will cost more. And every application will require a specific technical and economic study.

Fast Stock Removal

The first problem is definitions. VHS machining comprises two categories: high cutting speed and high rotational speed. The former increases the stock-removal speed through the use of materials able to withstand high temperatures, such as cubic-boron-nitride or silicon-nitride ceramics. The second, reserved for small tools (milling cutters, drills) makes it possible to eliminate under-speed machining through the use of high-rpm spindles. The technique is not really mastered yet: there is no general agreement on a precise and strict definition of very high speed. Actually, it all depends on what is machined. For turning and milling work, for instance, a cutting speed of 100 meters per minute is considered as traditional machining for structural steels. However, it becomes VHS machining for superalloys. The term VHS machining is also used when the cutting or rotational speeds for a given material are five to 10 times higher than traditional speeds.

Another problem is the technologies that must be implemented. In machining, the transition to high speeds has many repercussions on the tools and the materials they are made of: VHS machining interferes with the cutting process by altering the temperature, stresses, and the chip-cutting rotational speed. In the case of spotfacing operations, for instance, high-speed tools can remove 20 times more material if they are made of a silicon-nitride containing material. Once the tool shape has been defined, it is possible to increase the power of the machines up to 15-fold; unfortunately, this results in very small and very hot chips that are hard to retrieve and, in addition, may interfere with slides and motors. The problem, then, is how to protect the machines. Irrespective of the field considered, new parameters will have to be taken into account.

Last but not least, there is the problem of secrecy. VHS machining is one of these "research preserves" that manufacturers are reluctant to share. "Mentalities must change; decision-makers must get knowledgeable; set-up office staffs must get trained; and users must share their experience to a larger extent": this is something you

often hear when discussing VHS machining. The strategic dimension of the process, a source of efficiency for the future, makes it a closed, sensitive sector that does not readily publish data.

French Lag?

Companies jealously keep the secret of their progress in this field, and the French have often been accused of lagging behind. This they deny, just as they deny, in passing, the alleged German lead. "Certainly," Joel Vigneau, head of machining studies at SNECMA, observed, "the resources expended for university research in Germany are stupendous. But the spin-offs are very few... or they are kept secret."

Nevertheless, we should note that material implementations are still in the embryo stage. At present, VHS machining is truly operational only for light alloys. There are lathe or standard machining centers that ally a high spindle rpm and power. In the case of light alloys, they make machining easier, provide greater precision when working on thin walls, and reduce strains.

New Subsectors

In order to find new subsectors for the aircraft and the automobile industries, efforts are now geared to machining other materials such as cast iron, steel, titanium, and superalloys. These industrial sectors were not chosen at random: they are the only ones to have research laboratories and a development potential for these materials. For instance, Renault gears its efforts to finishing operations. The goal is to eliminate the semi-finished stage and, for cast iron, to go directly from the blank to the finished part. For the moment, the most remarkable progress involves machine components suitable for VHS machining (high-power spindles, high-speed numeric controls), materials (cermets, toughened ceramics, etc.), and production streamlining. The latter consideration is a vital one, as high-speed machining is really useful only in a machining shop equipped with a fast, automated, and efficient parts-flow system.

To accelerate the trend, a research program entitled "VHS Machining Technological Leap" was just created. It regroups large French companies: Renault, Peugeot, Aerospatiale, Dassault-Aviation, SNECMA, Brisard Machine Tools, Precise-France, Renault Automation, and Ascometal. By pooling their forces for a three-year period, these companies hope to master the cutting process and finalize the cutting tool and the tool-chain spindle. "Our program for the VHS machining of materials other than light alloys, extends over three years," Joel Vigneau, also a member of the Technological Leap program, explained. "By then, we will have defined the machines. We will then have to build them, and we do not expect any spinoffs during the next five years. Eventually, it will take about 10 years for the technology to reach small to mid-size industries [PMI's]."

Some subcontracting PMI's are actually beginning to get interested, but in a marginal way. Yet, the long-term

stakes, for manufacturers and for users, are far from insignificant, and the indifference shown for such a long-term goal might well prove quite detrimental.

Ten Years' Service Life

Machine-tools have an industrial service life of about 10 years. Therefore, it would be a good thing if VHS machining progress could be included in the next plant-renewal campaigns.

The ball is in the European manufacturers' court. At the latest Machine-Tool Show, the Japanese (Matsuura, Mazak, Makino, Nigata, etc.), for their part, clearly showed that they had no intention to miss the chance to acquire a comfortable position on the European market.

Pioneer Factory's Experience

92WS0445B Paris *TECHNIQUES & EQUIPEMENTS DE PRODUCTION* in French Feb 92 Supplement p 62

[Article signed O.E.: "Realmecca: Pioneers' Patience"]

[Text] Realmecca, the machine-tool manufacturer, adopted high-speed machining in 1986. "Since 1980, our clients had been encouraging us to work with extreme precision," Francois Lhuillier, the Realmecca technical manager, explained. "And, naturally, we came upon the idea of high-speed machining."

When it embarked in this way, the small to mid-size company of Clermont-en-Argonne (Meuse), which employs 120 people, decided to keep its feet on the ground. No question of offering "monsters" worth a few million francs and capable of machining parts several meters long, but only for a handful of aircraft or automobile manufacturers. "We developed machines suitable for small-size parts," Francois Lhuillier indicated. "For these applications, high-power spindles are not required. We make do with 7.5-kW or 10-kW spindles, which still rotate at 30,000 or 45,000 rpm." As a result, the cost of the machines offered is not prohibitive.

In spite of this, high-speed machines currently bring Realmecca only 3 million francs [Fr] per year, i.e. a very small percentage of the Fr109 million in sales (one half from machine sales; 35-40 percent from subcontracting; and the rest from an industrial valves and fittings activity). "It's a matter of habit," Francois Lhuillier sighed. "High-speed machining represents the same technological leap as the introduction of numeric controls in the early 80s. You can't give it to everybody just like that. It would be like giving a Formula-1 car to an ordinary driver, with no special training."

How long will the Realmecca pioneers have to wait? Two years? Five years? Ten years? It is hard to tell. Only one thing is certain: the transition will still require a lot of patience.

Swiss Expert Systems Diagnose Production Lines

92WS0471A Paris L'USINE NOUVELLE in French
19 Mar 92 p 68

[Article by Stephane Farhi: "Agie Equips Its Machines With Expert Systems; Machine-Tools: Computer-Aided Diagnosis is Becoming Widespread"—first paragraph is L'USINE NOUVELLE introduction]

[Text] Expert systems were already used to diagnose failures. They now tell users how to make repairs.

Expert systems designed to aid diagnosis are becoming widespread on machine-tools. The Swiss company Agie, the world leader in EDM (electric-discharge machining) machines, is entering the field. On two of its machine lines it offers as an option a technical diagnosis system based on the Maintex expert system generator developed by Framentec, the artificial-intelligence subsidiary of Framatome, for diagnostic applications.

At the origin of this development, which took three years and represents 5,000 hours of work, there is the Swiss manufacturer's concern to reduce repair times on EDM machines when a problem occurs. On machines of this type, prolonged downtimes are a handicap, as they often make it necessary to start parts production again. The specific surface conditions obtained by EDM—in which stock removal is achieved by an electric arc generated between the cathode (the wire or electrode) and the anode (the part to be machined)—require a machining precision and regularity that an interruption may compromise. The application is supported by a knowledge base that required one year of development time. Among other things, it contains all possible causes of downtime and a list of all machine components. Sixty-three downtime causes have been identified; they include electrical and motor problems, and component defects. For instance, the bearings mounted on the coils through which the EDM wire passes will rust under the effect of steam and will eventually seize, stopping the machine. The expert system diagnoses the failure and also provides a step-by-step repair procedure (removal, repair, installation) with diagrams.

The diagnostic system currently runs on a portable PC. Eventually, it will be available "on line," i.e. it will be connected directly to machine numerical controls. The development of this new tool gave Agie an opportunity to completely revise its development methods. As it designs its own numerical controls, it will alter its machines so as to use a single numerical control on the entire line.

Another advantage of the system is that it reduces travel, and therefore the maintenance technicians' intervention costs. Swiss machine manufacturers seem to find Maintex attractive: Rieter, a manufacturer of textile machines, Mikron, a milling-machine specialist, and Charmilles, Agie's direct competitor, have already adopted it. Agie plans to equip 200 machines with the Maintex system in 1992.

EUREKA Launches MAINE Program

92WS0471B Paris COMPOSITES ET NOUVEAUX
MATERIAUX in French 5 Apr 92 pp 2, 3

[Unattributed article: "Launching of the MAINE Program on Availability"]

[Text] Whereas yesterday's gains rested essentially on the control of productive times, tomorrow's gains should rest much more on the optimization of non-production times (controlling the maintenance policy and, more precisely, the global availability of production systems, a source of potential savings representing tens of billions of ECU [European Currency Units] per year in the European Community). Considering how much is at stake for Europe, the EUREKA [European Research Coordinating Agency] secretariat decided to launch a program called MAINE (Maintaining Availability in Europe); the program focuses on availability and is a major link in the large European project concerning the Factory of the Future. MAINE is designed to encourage the emergence of innovative R&D projects involving products or processes. The former will make it possible to conquer future markets, the latter will improve the competitiveness of existing markets (in the industry, of course, but also in sectors such as construction, transportation, services, etc.).

The R&D themes are many: integration of maintenance into the entire equipment life cycle not just the operating phase; integration of maintenance and quality control, as the quality of parts and subassemblies is directly related to the characteristics of the equipment used to produce them; integration of maintenance and safety, at labor and production-system level (accidents at work) and at environment-protection level (pollution, nuisances, etc.). In France, ideas of ambitious projects are already emerging: tools to aid document management; how to control subcontracting; design workshops for industrial systems geared to operational safety, etc. We should mention that the English company Vosper Thornycroft, a naval engineering specialist, just filed a project called Integrated Logistic Support (ILS) and is looking for partners to adapt this approach—used today in the arms industries—to streamline maintenance procedures when technical systems are transferred to civil industries. The objective is to reduce the overall cost of the systems proper. The project consists of four stages, lasting a total of about 30 months; the first stage could start already this month. Following the EUREKA procedure, a network of national committees was set up which, this year, is chaired by France. Maine Project Coordinator: Mr. Gilbert Liegeois, MRT [Ministry of Research and Technology] 21 rue Descartes, 75231 Paris cedex 05. Tel (1).46.34.31.80.

Maine Project Leader: Mr Daniel Richet, ADEPA [Association for the Development of Automated Production], 13-17 rue Perier, 92120 Montrouge. Tel. (1).46.57.12.70.

LASERS, SENSORS, OPTICS

Italy: Pirelli Develops Ultra High-Speed Laser

92MI0359 Milan L'INDIPENDENTE in Italian
17 Mar 92 p 17

[Text] A prototype of a small, ultrafast laser source for use in telecommunications has been developed by the Pirelli Cables research laboratory. This achievement opens up new development prospects primarily in the field of transoceanic fiber optic links, since extremely short-pulse laser technology creates a transmission capacity of 600,000 telephone channels per fiber compared to the current 7,000. The market for these systems is expanding rapidly and is estimated to reach 6.2 trillion lire by 1996.

After having developed and manufactured erbium fiber optic amplifiers (used to maintain the continuity of a signal along the optical fiber without resorting to regenerators), Pirelli has solved the problem of improving the laser sources used in transmission. In line with optical amplifiers, the signal can be transmitted through sequences of extremely strong and very short pulses, called solitons, which propagate for thousands of kilometers. The application of this technique was previously limited to laboratory tests because of the absence of compact and reliable sources able to generate such short pulses. Precisely by using the erbium-based fiber optics technology, Pirelli has succeeded in overcoming this problem.

Germany: New Laser Developments Described

Tube Laser Research

92WS0441A Landsberg PRODUKTION in German
23 Jan 92 p 8

[Interview with Ulrich Wittrock, head of Tube Laser Project at the Solid State Laser Institute; name of interviewer, date, and place not given: "Superior in Efficiency and Power: What Can Be Expected From the Tube Laser in Materials Processing"; first paragraph is PRODUKTION introduction]

[Text] Berlin—Nearly all solid-state lasers use a rod as an active medium. Slab lasers, which work with a slab-shaped crystal, are still the major exception. However, a new structural shape is already emerging: the tube laser. What can this laser do, how does it differ from other lasers, and what can be expected from it? PRODUKTION posed these and other questions to Ulrich Wittrock, who is in charge of the Tube Laser Project at the Solid-State Laser Institute, the leading research facility in this area.

[PRODUKTION] In recent times, more and more attention has been given to tube lasers, primarily because of the research work at the Solid-State Institute. However, this technology is actually not that new. How long have tube lasers been around?

[Wittrock] The first solid-state lasers with a tubular, active medium were built in the United States back in the 1970s. However, the results of the tests conducted at that time were unsatisfactory.

[PRODUKTION] How can one envision the function of a tube laser? Is it true that the tube geometry basically corresponds to that of a rolled up slab?

[Wittrock] The idea of a rolled up slab is rather close to the reality, especially in terms of thermal effects. Cooling is carried out at the interior and exterior surface of the tube, and there is a temperature distribution only in the radial direction. In contrast to the slab with its zigzag beam, however, the thermal lens is not counterbalanced. The emerging beam is ring-shaped, whereby the thickness of the ring corresponds to the tube's wall thickness. When focusing with a lens, the hole in the center disappears; only a tiny penetration point in the middle remains. In that case, the energy distribution is relatively homogeneous.

[PRODUKTION] What are the most important advantages of the tube laser compared to the other geometries?

[Wittrock] One significant advantage is the high efficiency of 7.5 percent. In comparison, rod systems achieve around 4 to 5 percent. The high efficiency results from the positioning of the flash lamps inside the tube and the more effective absorption of the lamp radiation that results from this. This is because all of the light from the flash lamps is forced to hit the crystal. In addition, the part of the light that is not absorbed immediately hits the crystal again after a single reflection on the pump chamber.

This process is different with the rod. There, an elliptical cavity is often used, in which the rod and flash lamp sit side by side. In this system, a large amount of the light from the flash lamp makes it to the crystal only after reflection on the pump chamber. The active medium then absorbs part of the light, while a larger share penetrates the rod and in turn hits the crystal only after several reflections.

The second advantage of the tube geometry is the high average power level that the tube can sustain. The average power level is limited by the thermal stresses in the crystal. While with the rod the thermal stresses are independent of the diameter, with the slab the average power level depends on the height-width ratio. A thin, high slab can give off more power than a less high, thick slab. This is because with a thin slab, the heat can be transported out very quickly. The same is true in principle for the tube: With a thin wall, a very high average power level can be achieved, since the breaking limit of the tube is very high. In contrast, thicker tubes do not achieve these high average power levels, but do have better absorption of the pump light.

[PRODUKTION] What power levels can be achieved with tube lasers?

[Wittrock] During tests, power levels of as much as 1 kilowatt [kW] have been achieved on the system installed at our institute, and the limits of this setup—thus, with the existing power supply unit and current crystal—should be around 1.5 kW. If the system is further optimized—i.e., a stronger power supply and higher-power flash lamps are used—levels of up to 2 kW could be achieved. With a redesign, in which a tube with thinner walls is used and everything is configured for high power, it is theoretically possible to get 3, or even 4 kW from a crystal.

[PRODUKTION] But certainly there are not only advantages to tube lasers. What are the drawbacks?

[Wittrock] The biggest disadvantage is no doubt the poorer beam quality, and thus the poorer focusability. The achievable focal spot is larger and after the focus point the beam then diverges faster. Numerically speaking, the beam quality of the tube laser tested by us with a stable resonator is around three times worse than that of a high-performance rod laser with a similar power level.

[PRODUKTION] Surely with a limited beam quality, the tube laser is scarcely suitable for cutting. What are the conceivable applications that you foresee for the tube laser?

[Wittrock] With the plane-plane resonator currently in use at the Solid-State Laser Institute, the beam quality is adequate only for applications in which there is no need for fiber transmission and for very high beam quality. Cutting is not possible, but the tube laser would be appropriate for surface hardening or for certain welding jobs, for example, in which either the complete laser or else the workpiece is moved.

[PRODUKTION] The slab laser is criticized for being too expensive compared to the conventional rod laser. What is the cost situation with the tube laser?

[Wittrock] The only expensive thing about the tube laser is the necessary crystal volume. Around 15 rods can be produced from the volume of one tube laser, whereby, there can be no defects in the raw crystal. This is not the case with the rod, because even where there are minor defects, small rods can still be produced from the areas that are okay. Nevertheless, the tube laser can be considered economical in terms of overall cost. An advantage of the tube geometry in this sense is the fact that only one laser head is required even for high power levels, and a large amount can also be saved in the power supply unit, which is currently the greatest cost factor in high-performance lasers.

[PRODUKTION] The tube laser that you have developed is the result of a research project. How long until an industrial tube laser is on the market?

[Wittrock] In principle, the laser that is in place here can be used for industrial materials processing. However, the technical standard is not the only decisive factor; the

system must also be produced. At present, however, the possible quantities are still very small, so that the decision to include this product in a company program is still a difficult one, despite all its advantages. Unfortunately, therefore, it is impossible to give a concrete date for when a tube laser will be on the market.

Slab Laser Research

92WS0441B Landsberg PRODUKTION in German
23 Jan 92 p 9

[Interview with Dr. Kurt Mann, product manager for Lasersysteme; name of interviewer, date, and place not given: "With the Properties of the Slab Laser: Technical Innovation Instills Best Qualities in Rod"; first paragraph is PRODUKTION introduction]

[Text] Schramberg—Crystal geometries that differ from the proven rod, such as the slab or even the rod, still constitute the major exception in solid-state lasers. The most important reason: the simple structure of the rod laser. The advantages of new crystal geometries such as the slab, and how all of this can be achieved even with conventional rod lasers, thanks to the latest developments, was the subject of an interview with Dr. Kurt Mann, product manager for Lasersysteme.

[PRODUKTION] What are the potential advantages of the slab?

[Mann] In principle, the slab is nothing fundamentally new. Rather, the idea of the slab has existed ever since the beginning of solid-state lasers. The background to this is the fact that the light-producing crystal is heated up unevenly during pumping—more in the middle than on the periphery—and because of the different refractive indices, its optical properties change. Since in the rod the beam passes parallel to the rod axis, a "thermal lens" emerges with every rod laser. This effect cannot be avoided, due to the inevitable temperature differences in the optical medium.

With the slab laser, unlike with the rod, the beam passes through all areas of the crystal in a zigzag motion, so that the thermal lens is counterbalanced. Initially, however, it was not possible to generate large crystals, and moreover the more complicated technology could not be properly controlled. For example, significantly greater polishing was necessary. The manufacturers gained the upper hand over this only over the course of time.

Still, the question arises of how the process is even impaired by the thermal lens. Low-performance lasers are pumped at such a low power level that the thermal lens plays a completely ancillary role. Only at a certain power level does the thermal lens become critical, because focusing assumes forms that are so pronounced that the laser cannot be kept stable across the entire pumping level range.

Another significant advantage of the slab is the higher destruction limit, which can be raised by an appropriate

choice of the ratio of height to width. In turn, however, this brings with it the disadvantage of a poorer beam quality. For a long time, this was the biggest problem of the slab, a problem that was solved only through modified resonator concepts. However, these concepts mean a decrease in efficiency, and thus in laser performance.

[PRODUKTION] You say that your company's new rod laser has properties that make it comparable to the slab. How is that possible?

[Mann] The thermal lens is unavoidable in the rod laser. The only thing that you can do is to counterbalance the thermal lens in some way. We use the cable to do this. In our case, the light guide of the cable acts as a counterbalance, whereby there is actual know-how for bunching the laser light into the fiber. Understandably, I would prefer not to go into details here. But I will say this: We are working with a compact, fixed optic, and thus with a completely passive system. In any event, the user is primarily interested in the result, and here we are using proven and low-cost technology to achieve a beam with an absolutely constant beam quality, regardless of the pump power level. Thus, the divergence at the fiber end remains constant, and the significantly more expensive slab cannot offer more than this.

[PRODUKTION] Are there other possibilities for applying these properties to a rod?

[Mann] It is also possible to measure the variable thermal lens and make adjustments through a variable optic. However, this system works with moving parts, meaning that it is more expensive and also more sensitive.

[PRODUKTION] One of the most important criteria for users is cost. To what extent is the slab more expensive?

[Mann] With the slab, the costs of the raw materials alone are two to three times greater than those for the rod. In addition, there are polishing costs, which are of the same order of magnitude. Since the costs for the power-supply electronics are at the same level, the result is a significantly higher price for a complete slab system, compared to a comparable rod laser system.

Solid-State Laser Research

92WS0441C Landsberg PRODUKTION in German
23 Jan 92 p 10

[Interview with Samuel Simonsson, general manager of Rofin Sinar; name of interviewer, date, and place not given: "Supplementing, Not Displacing: Rofin Sinar Intensifies Activities in Solid-State Lasers"; first paragraph is PRODUKTION introduction]

[Text] Hamburg—Two years ago, Rofin Sinar, the world's biggest producer of CO₂ industrial lasers, presented its first Nd:YAG laser, which had a 500-watt output. The next system, with 1,200 watts, is almost ready for mass production. The importance that Rofin

attaches to solid-state lasers and the developments anticipated in the near future were the subject of an interview with general manager Samuel Simonsson.

[PRODUKTION] Mr. Simonsson, every laser user is certainly familiar with Rofin Sinar as a manufacturer of CO₂ lasers. Nor is Siemens' excimer laser branch, which only recently became a subsidiary of Rofin Sinar, unknown to insiders. In the rapidly expanding area of solid-state lasers, however, Rofin is considered a newcomer. Consequently, what is the importance of Nd:YAG lasers within the company?

[Simonsson] Our first task is to develop and build laser beam sources for all somewhat perfected applications in the field of industrial materials processing. We are doing this step by step. Our traditional product was the CO₂ laser. But once we had achieved a certain position on the market and, under the Siemens roof, also gained expanded resources for product development in particular, it was in fact obvious that we would also turn to the Nd:YAG laser.

[PRODUKTION] What are the future prospects for this? Will the importance of the Nd:YAG increase disproportionately at your company?

[Simonsson] I cannot say at present. The relative share will certainly increase here. However, that is because we are building a relatively large number of systems in our established field—the CO₂ laser—while we are still relatively new to the Nd:YAG lasers. Still, I do feel that in the long run we will be able to develop two equally strong legs to stand on.

[PRODUKTION] Thus, the often cited displacement of the CO₂ laser by solid-state lasers will not be a reality?

[Simonsson] We regard the Nd:YAG laser as a very good supplement to the CO₂ laser. Thus, it is less a question of replacing or displacing than of supplementing in areas where the Nd:YAG can demonstrate its specific advantages over the CO₂.

[PRODUKTION] What advantages would you emphasize in this regard?

[Simonsson] One essential advantage is the ability to conduct via optical waveguides, which is useful in 3D processing in particular.

[PRODUKTION] Even Rofin Sinar's first solid-state laser, which was presented a good two years ago, featured a relatively good output of more than 500 watts. The 1.2 kW laser is now nearly ready for mass production. Will developments continue at this pace?

[Simonsson] In principle, it is possible to add further cavities, which many manufacturers are in fact already doing. Each cavity then adds around 600 watts of power, or even more. But each individual cavity also brings with it further complexity, and the product becomes more sensitive to adjustment. The question arises here of how to continue with this type of upgrading.

At present, we see no problems with using up to two cavities. Further studies will show whether we will move on in the direction of three or even four cavities, or whether we will try to formulate a completely different concept. In short: We are still in the process of deciding the road that we want to take in order to achieve 2 to 3 kW. But this much is already certain: We will not simply upgrade and pass certain limits that we clearly do not want to pass.

[PRODUKTION] Your new solid-state laser achieves an output of 1.2 kW with only two cavities, while other manufacturers need up to four cavities for the same power level. How does this laser differ from others?

[Simonsson] One advantage of our laser is a high degree of efficiency, higher than in most other systems. This also means that we get up to 600 watts from one rod and up to 1,200 watts from two rods.

[PRODUKTION] How high is the efficiency of your laser?

[Simonsson] Any "normal" engineer will be shocked by these figures, because we are somewhere between 4 and 5 percent. However, one must consider here that conventional solid-state lasers achieve only 2 to 3 percent.

[PRODUKTION] Is that the only advantage?

[Simonsson] No. There are others, which are perhaps even more important. A little bit of background: It is basically true that the average power level of a laser results from the product of pulse energy and frequency. Thus, with a doubled cavity it is possible to increase power only by increasing pulse power with a constant frequency or keep the pulse energy constant and increase the frequency. A mixture of the two is also possible. Which of the two alternatives is better depends on the application in question.

With our laser, we have now become the first manufacturer to opt for a solution that makes it possible to choose either method, depending on the application. In this way, it is possible to achieve a higher pulse energy at the frequency of the previous 500-watt laser through synchronous running of the two pulse chambers. The advantage of this method of operation: Very large welding depths can be achieved, and thicker materials can be cut than has been the case thus far. Through alternating operation of the two pulse chambers, however, the laser can also be operated with the pulse energy of the 500-watt system, but with double the frequency. This control principle is suitable for thin-sheet cutting or for three-dimensional cutting of car body components, where the higher frequency means a greater processing speed.

MICROELECTRONICS

EC Project on Hyperfrequency Circuits Presented 92BR0214 Paris *ELECTRONIQUE INTERNATIONALE* HEBDO in French 16 Jan 92 p 18

[Article by Jean-Charles Guezal: "Hypers More Democratic With ESPRIT"]

[Text] The ESPRIT project AIMS [Advanced Integrated Millimeter-Wave Subassemblies] brings six European partners together to develop the millimeter-wave components of the future.

The development of improved, microwave components, low-cost millimeter-wave subassemblies, and general-purpose civilian applications: This is the objective of ESPRIT project No. 5032 (AIMS) conducted by Thomson-CSF. The originality lies in the very nature of the ESPRIT project, in which three nations (France, Denmark, and Germany) are represented by manufacturers and a university laboratory.

At the origin of this project there is the partnership between the three manufacturers who have each defined their own needs. They are the Danish firm Elektronik Centralen, for the "ground" segment of a V-SAT transmitter-receiver module operating at 30 GHz; Alcatel Espace, for its "space" component; and Daimler-Benz Aktiengesellschaft, which will contribute a short-distance bidirectional communications system. These requirements are subsequently transposed into circuit specifications and then into components by Thomson Composants Microondes and by Telefunken Systemtechnik.

In France, the Science and Technology University in Lille is contributing by designing pseudomorphic, field-effect HEMTs [high-electron-mobility-transistor] and heterojunction bipolar transistors (HBTs) developed in Thomson's central research and development laboratories (LCR). The noise factor of the HEMT transistors is currently 0.55 dB gaining 11 dB at 12 GHz and 1.6 dB gaining 8 dB at 44 GHz. These are certainly not record results (the Japanese have reached 100 GHz) but the technological venture aims more specifically at the production of more compact, even portable, future millimeter-wave subassemblies, which could be mass produced at low cost after 1994. Integration is the key word.

MMIC [microwave monolithic integrated circuit] and HBT Transistors Under Study

Certain functions, like the local synthesizer oscillator, are currently the focus of all attention. TCM thus designed a 27.5-30 GHz synthesizer in hybrid technology. This synthesizer uses 27-MHz frequency steps for an output level of +10 dBm. Its phase noise is -70 dBc/Hz at 10 kHz from the carrier. The production of monolithic microwave integrated circuits (MMIC) combining HBT transistors and Varactor diodes is scheduled for the second phase of the project. This operation will

be carried out by the TCM application center in Massy. There are urgent requirements and possible applications are not lacking: miniature terminals for satellite links, portable telephones and high-rate data transfers. In the automobile sector, 60-GHz bidirectional communications systems and 80-GHz anticollision systems should also be mentioned. For simple identity badges using a 1-GHz bandwidth, passing to a 60-GHz frequency will lead to a considerable increase in the number of potential users.

[Box]

SGS-Thomson presents three MMIC amplifiers for wideband systems on 50 Ohms in class A. All three are contained in a standard RF transistor package of the XO72 type which costs less and has higher output power than those offered by plastic packages. The AMP0572 has a gain of +8 dB for a power of over 23 dBm up to 1 GHz. Its noise factor is 6.5 dB and it operates at 12.5V/165 mA. With an identical noise factor and gain, the AMP1072 offers 0.5 W up to 1 GHz of power while the AMP3072 delivers 1 W up to 400 MHz.

These three amplifiers require a reduced number of external components only and can be used as control circuits for discrete, higher-power amplifiers, in digital cellular telephones, for instance.

Applications for Insulated Gate Polar Transistor Discussed

92WS0491A Duesseldorf VDI NACHRICHTEN
in German 27 Mar 92 p S21

[Article by Achim Scharf: "Power Electronics Gets Power Drives Moving"]

[Text] VDI-N, Munich, 27 Mar 92—The three concepts—higher operating voltages, switching frequencies, and power outputs—nicely sum up the trends in power electronics. Electrical power engineering especially benefits from these trends, as the Hannover Fair shows. Power semiconductors also contribute to the fact that electrical drive controls are pushing modern mechanical and hydraulic drives out of the picture.

The bipolar npn-power transistor (in cascade connection; otherwise referred to as the Darlington circuit), which has been used extensively to date, is current-driven (via the base) component with a relatively low input impedance and therefore a relative higher applicable control power. The Darlington modules, in which the collector of the input transistor drives the base of the output transistor, are today available up to operating voltages of 1200 V, switching current of 300 A, and switching frequencies up to 3 kHz.

Unipolar transistors (FET - field effect transistor), as their name suggests, are controlled at the gate by means of an electrical field. In static operation, almost no input current flows, while in dynamic selection, the input capacitance must be reloaded in an order of magnitude

of nanofarads. An important advantage is the thermal stability, since the drain source conductance decreases with higher chip temperature. Short-circuit-proof systems are therefore possible using FETs. FETs up to 10 kW are employed in power engineering; in modular construction, they are used to control even greater powers.

The IGBT [insulated gate bipolar transistor], in the end a bipolar transistor (doubled conduction mechanism by means of negative electrons and positive holes) with a MOSFET input (unipolar electron conduction mechanism), sensibly combines the positive properties of both concepts. The conducting state characteristic is comparable with that of the bipolar transistor, while the short switching times and the high input impedance are close to those of MOSFET.

Correspondingly low is the control power requirement, also on the basis of the relatively small chip area as compared with a MOSFET of equal value and therefore of lower input capacitance. In addition, the IGBT exhibits the highest current-carrying capacity relative to the chip area, thereby making it possible to develop compact modules with high power density. The highest output current reached to date is 300 A at 1200-V operating voltage.

Admittedly, bipolar Darlington and power-MOS-components have been dominating the market so far. From 1990 (\$560 million) to 1995, the world market for power-MOS-components will continue to grow at a rate of about 20 percent yearly. According to an internal study conducted by Siemens, the market for 1995 should reach \$1.7 million.

Modules Win Substantial Part of the Market

The expectations for the modules are even more impressive. Market analysts predict a jump from \$25 million in 1990 to \$320 million in 1995. This would correspond to a change in total market share from today's 4 percent to 19 percent in 1995.

Electric drives, with about 30 percent, represent a substantial part of the world market for automation technology. They may therefore be considered a base technology with high innovation potential. Developments in power semiconductors contribute to the fact that electrical drive controls have put the most modern mechanical and hydraulic drives on the back burner.

Frequency converters, from which one- and three-phase AC motors are powered, are an essential component. They convert the rigid net frequency into a variable output frequency with power outputs up to 100 kW. In this matter, IGBT-modules are rapidly replacing the previously used Darlington modules for the following reasons: (1) because of the potentially higher output frequencies of up to 20 kHz, namely, above the audible level for humans, and (2) because of the simpler selection of IGBTs as the voltage-sensitive element with MOS input.

Frequency converters are being bought throughout the world to a value of about 2 billion German marks [DM] a year, about one-fourth of which go to Germany. These figures alone suffice to illustrate the strategic weight of power electronics in this segment of the market, which is so important to automation.

Microelectronics and power electronics are also growing together in field of application, where the trend is toward "intelligent modules." Besides the pure power switches, logic circuits, which protect the IGBTs and therefore the attached motors against overload and which in an emergency shut off the power stage, are also integrated in the module.

Such overloads can be caused by blocked rotors, in which case, among other things, the power stage in the frequency converter becomes impermissibly hot because of the rising output current. The internal protective wiring senses the excess temperature and effects a shut-down. In this way, not only the module itself, but also the load and the attached motor is protected against impermissible operating conditions.

Drive controls also profit from progress in power- and microelectronics, since they alone make new motor concepts possible. According to the Frost & Sullivan market research institute, drive controls in the important European countries will reach a turnover volume of &2.6 billion in 1995. Germany, Great Britain, France, and Italy again offer the best turnover prospects. Germany should, with a turnover growth from \$929 million in 1990 to \$1.33 billion in 1995, retain her European share of 51 percent.

Switched reluctance motors (SR-motors) have gained in importance of late and will play an even greater role in the future. They are particularly well suited for digital control, a development, characterized by lowering costs for all drive controls, should be of great importance. Their use for axle drives for machine tools should increase rapidly in robotics and industrial process control.

In the SR-motor, the magnetic circuit tries to approach the point of minimal reluctance. Rotor and stator are laminated. Each stator pole has a field coil. Opposite poles are arranged so as to form the north/south pole pair of a phase.

Phase Currents Cause Permanent Torque

The phase is excited through two electronic switches in a current direction, in which a permanent torque is achieved by means of properly angled rerouting of the phase currents. Speeds of up to 10,000 rpm have already been reached with these motors; the rerouting of the phase currents has to proceed equally rapidly. Consequently, only IGBTs or MOSFETs can be considered in the output stage.

The efficiency of the SR-motor is completely comparable to that of a motor excited by a permanent magnet in all

four quadrants. Moreover, the SR-motor can be operated in all four quadrants. Because the windings are only driven unipolarly, the necessary power electronics are simple to develop. By means of additional control expenditure, a lower torque ripple can even be achieved. The SR-motor is just as robust as a conventional AC motor, since the rotor is made solely out of iron. In the event of a winding failure, the motor is better protected than in other motor technologies. Prerequisite for its development, however, are fast, reliable switching power semiconductors. They are in the final analysis the function-determining element in motive power engineering. These trends were discussed not just at the Hannover Fair from 1-8 April, but also at the PCIM '92 professional conference with exhibit, which took place in Nuremberg from 8-10 April

NUCLEAR R&D

Eastern German Researcher Leads Max Planck Study of Nonconventional Radiation

92MI0423 Goettingen MPG-SPIEGEL in German
12 Mar 92 pp 13-14

[Article by Michael Globig: "How an Atom Interacts in the Resonator—Quantum Mechanics-Based Descriptions Replace Conventional Models; Nonconventional Radiation Team Begins Work"—first paragraph is MPG-SPIEGEL introduction]

[Excerpt] On 1 January 1992, the Max Planck Society's "Nonconventional Radiation" team began its work at the Humboldt University in the eastern part of Berlin. The group, which has been established for a five-year term, will be led by theory of physics professor, Harry Paul, an expert of international repute from the former GDR, whose specialties include the use of quantum mechanics to describe fields of radiation. The proposal to found the team, which comprises five other scientists in addition to Professor Paul, was put forward by the Max Planck Institute of Quantum Optics in Garching near Munich. Until the end of 1996 the institute will also have administrative and scientific responsibility for the team, which will then be integrated into the Humboldt University.

[Passage omitted] The team's partner institute, the Max Planck Institute of Quantum Optics in Garching, will be giving the Berlin physicists the opportunity to have their theories tested experimentally. There had been no such opportunity at the Central Institute of Optics and Spectroscopy—the former GDR Academy of Sciences institute where Professor Paul had worked since 1969 and where it was mainly industry that decided what research the experimental groups were allowed to carry out. The close cooperation now commencing with an experimental institute is, therefore, a completely new experience for Professor Paul.

Germany: Juelich R&D Center Presents Cooler Synchrotron*92MI0427 Bonn WISSENSCHAFT WIRTSCHAFT POLITIK in German 25 Mar 92 p 4*

[Text] The Juelich Research Center (KFA) is exhibiting at the Hannover fair on the joint Association of Major Research Establishments stand in hall 18. The KFA exhibit concerns the construction of the "COSY Juelich" cooler synchrotron, which is scheduled to come on stream in the course of 1993. The KFA is also exhibiting a thin-layer solar cell quality control process (see below) on the joint Solar Energy Research Association stand (specialized energy and environment fair, hall 21).

The COSY Juelich cooler synchrotron is an accelerator and storage ring for "cooled" i.e., very well ordered, ion beams, primarily proton beams, in the 40 to 2500 MeV energy range. The source of these particles is the JULIC cyclotron at the KFA Institute of Nuclear Physics. The storage ring itself consists of a ring-shaped vacuum tube 184 meters in circumference, in which the stored particles circulate approximately one million times per second. They are focused and kept on course by magnetic fields.

The cooled beam can be used either inside or outside the ring itself. The beam quality and proton energy are suitable both for nuclear physics experiments and for medical applications.

The beam of particles enclosed in the ring is held on its circular path by 24 dipole magnets. A total of 56 tetrapole magnets focus the beam—like lenses in photo-optics—according to the requirements of the experiments being performed in the ring. Defects that occur on dipole and tetrapole magnets owing to production tolerances and material properties produce resonances in the beam and, consequently, particle losses. These undesirable properties can be countered by placing six-pole magnets in the accelerator at positions that can be determined precisely beforehand as most advantageous to the ions. Conversely, six-pole magnets can be used to generate oscillations in the beam for the specific purpose of withdrawing protons from the ring for use in experiments performed outside the COSY ring.

The cooler synchrotron is being used to carry out basic research in the area between conventional nuclear physics and high-energy physics, for which purpose stationary target protons are bombarded with proton beams. As a result of the collision, new particles, e.g., pi, K and other heavy mesons or lambda particles, can be formed. Not found in nature, they are composed of quarks and are very short-lived.

France: PVC Heat Exchange Block for Cooling Towers Developed*92WS0446A Paris L'USINE NOUVELLE in French 12 Mar 92 p 25*

[Article by Jean-Pierre Gaudard: "Plastival Equips Cooling tower of Golfech 2 Nuclear Power Plant With PVC"—first paragraph is L'USINE NOUVELLE introduction]

[Text] In partnership with SCAM (GEC-Alsthom group), the Franche-Comte-based company is developing a new technique for industrial cooling.

Inside the cooling tower of the Golfech 2 nuclear plant now being completed is a hidden innovation. For the first time, the heat-exchange surface is composed of honey-combed PVC [poly-vinyl chloride] blocks which though lightweight (25 kilograms per cubic meter) offer optimal contact between air, cooling fluid and water. The 20,000 cubic meters of this new product—called "packing," it was developed by SCAM—was manufactured by a Franche-Comte-based company, Plastival, a subsidiary of the Belgian chemical group LVM (EMC group).

According to Plastival, which manufactures extruded PVC products for building (windows, enclosures, etc.) and for industry, "packing" is proving to be a big seller. Of course, PVC has been used in the nuclear industry for over a decade. The cooling towers of generating stations such as Saint-Laurent-des-Eaux, Chinon and Cattenom are fitted with single-sheathed PVC batten instead of traditional wood batten. But the properties of "packing" are such that SCAM is developing this technique for numerous refrigerants destined for the chemical, petrochemical and sugar industries. A shipment of 5,000 cubic meters has just been sent to a work-site in Belgium, and additional sales have been made in Spain, Portugal and Poland. To keep up with orders from SCAM and maintain the quality standards upheld in the nuclear industry, Plastival has built a special production line for continuous extrusion and thermoforming of ultra thin sheets of PVC. More recently, for some of its foreign contracts, Plastival has decided to quit shipping prefabricated "honeycombs." To save on transport costs, the sheets are assembled and sealed at destination.

Starting from nothing four years ago, the fabrication of "packing" has grown now to about 10 percent of Plastival's 150 million French franc [Fr] turnover and accounts for the lion's share of the company's manufacturing activity.

But Plastival is not forgetting its traditional building sector, which generates three-fourths of its sales. Last year, though not abandoning the town of Clerval in Doubs, the company left its historic plant site to build a brand new factory with an annual production capacity of 12,000 tons of PVC mixtures—in order to accommodate rapid growth, as Plastival's turnover has increased by more than 60 percent since 1988.

SUPERCONDUCTIVITY**Warm Semiconductor Material Developed***92BR0273 Paris SCIENCES ET AVENIR in French Mar 92 pp 12-13*

[Text] At -145°C, chemists have once again raised the superconductivity record up the thermometer scale by

some 20°. Far from the early media fever, chemists continue to explore the superconducting capacities of a group of ceramics in which electric current moves without resistance. The compound was identified by a trio composed of Peter Edwards and Ry-Shi Liu (University of Birmingham) and Jeffrey Tallon (New Zealand). It contains thallium, barium, calcium, copper, and oxygen. But the ceramic had to undergo a shock treatment to become superconducting: It was subjected to a pressure of 5 [metric] tons per square centimeter, heated to 910°C for three hours, then to 750°C for 10 days, and finally annealed under oxygen (2 bar) and nitrogen (20 bar). During this process, the ceramic lost 5 percent of its weight. The scientists interpret this as the loss of the thallium ions which brings about the formation of cation holes that control the superconductivity of the material.

TELECOMMUNICATIONS

Ericsson Penetrates Japanese Mobile Phone Market

92BR0225 Paris *ELECTRONIQUE INTERNATIONALE*
HEBDO in French 30 Jan 92 p 10

[Article by Elisabeth Feder: "Ericsson Makes Inroads into the Japanese Digital Mobile Phone Market"]

[Text] The Swedish group, which is already active in many Asian countries, is making inroads into Japan by becoming the supplier for the infrastructure of a digital mobile phone network.

The Swedish group Ericsson has recently been selected as supplier by Tokyo Digital Phone (TDP), one of six future operators of a digital mobile phone network in Japan. Under an agreement being negotiated, the financial details of which will only be known next April, Ericsson will be responsible for the development of the network, as well as the installation of the switches and of the base stations. The Swedish group will be the supplier for an initial phase which must be operational by 1994. After signing the agreement, and in parallel with the initial orders, Ericsson will establish a joint company with a Japanese partner for the development and the installation of the network. Development of the software will be done locally.

Twenty Million Potential Subscribers

Japan has only a single, analog mobile phone network with only one million subscribers after 11 years of operation by NTT [Nippon Telephone and Telegraph]. The monopoly situation (the systems are supplied by NEC [Nippon Electronics Company]), along with excessively long delivery times and exorbitant prices, has always put a brake on the development of a customer base. Today, the administration, which is planning six digital networks, three of them in the 900-MHz range and three in the 1,500-MHz range, is expecting a lot from deregulation. Analysts anticipate a potential 20 million

subscribers by the year 2000. Japan, being considered as a sufficiently major market by itself, selected a standard which is neither compatible with the European digital network (GSM) nor with the American digital network. It employs, however, similar coding techniques, as well as the TDMA [time division multiple access] concept. The Japanese standard could, moreover, be implemented in other Asian countries.

TDP Shows its Independence

The Tokyo Digital Phone consortium was established in July 1991 with the purpose of obtaining a license for the operation of a digital mobile phone and associated services network. The consortium is composed primarily of Japan Telecom, Pacific Telesis International, East Japan Railway Company, Metropole Service, and Cable & Wireless; its shareholders also include a large number of banks, as well as the major industrial groups. Before submitting its license request, TDP had to select a supplier. Confronted with competition from other consortia, whose shareholders generally include a Japanese network supplier, TDP appears to have preferred to assert its independence by selecting Ericsson. The Swedish group was thus the logical front-runner by virtue of its previous success as the supplier of digital networks in numerous countries. Specifically, it had been selected by Hong Kong for the introduction of an American-type AMPS-compatible network. In addition, Ericsson has again recently been selected by Taiwan for the extension of the island's digital mobile phone network. The contract represents \$115 million.

Philips Develops Optical Amplifier for Data Transmission

92BR0252 Paris *ELECTRONIQUE INTERNATIONALE*
HEBDO in French 27 Feb 92 p 24

[Unsigned article: "A 2.5-Gbit/s Transmission over 200 km of Optic Fiber Without a Repeater"]

[Text] A cooperative project between Philips' telecommunications laboratories at Nuremberg, Germany and its laser production center at Eindhoven, the Netherlands, has resulted in the development of a powerful optical amplifier which, implemented on an SDH [synchronous digital hierarchy] transmission system, can transmit data at a speed of 2.5 Gbit/s over more than 200 km without a repeater. The optical amplifier uses a laser source emitting a 12 dBm signal, i.e., with a power of approximately 14 mW in the 1,550 nm wavelength range. The transmission was carried out on a monomode fiber with an optical dispersion of 1,300 nm. Until now, systems could cover a distance of only 50 km without using a repeater. This result, which has been achieved by Australian Telecom, could eventually lead to the replacement of electric repeaters with this optical amplifier.

Italy's 1991-94 Telecommunications Programs Presented

92MI0337 Turin MEDIA DUEMILA in Italian Feb 92 pp 68-76

[Article by Roberto Parodi, Head of SIP's Marketing Strategies and Giovanni Battista Di Stefano, Head of SIP's Network Services: "Italy's Forthcoming Telecommunications Scenario"]

[Excerpt] [Passage Omitted]

The Development of Telecommunications Networks in Italy

A major operation to improve and upgrade the national telecommunications network has been under way for some years now. The key elements in this process are the digitization of basic network infrastructures (exchanges and trunk networks) and common channel signalling between exchanges.

A significant effort has been put into this development and renewal, which has been primarily directed toward improving the quality of telephone services and increasing the range of services offered. Digitization and the introduction of a common signalling channel are indispensable prerequisites in a development process aimed at providing advanced services and networks. By using standard infrastructures the subscriber's ever-increasing demand for personalized services can be satisfied in a more economic and flexible manner.

In line with the process of digitization of exchanges to be completed by the year 2000, SIP's [Italian State-Owned Telephone Company] development plans forecast that approximately 68 percent of exchange numbers will utilize the new technology by 1995. Digitization of the interdistrict trunk network should be completed by 1994. The most important network development projects center around digitization, particularly ISDN [integrated services digital network] the intelligent network, mobile services, and, in the medium to long-term, broadband services.

ISDN Development Strategy in Italy

The concept of the ISDN service and the role it should play in the range of telecommunications services offered by a company, varies considerably between operators in the sector, especially between those in the United States and in Europe.

The main causes of this difference are the various kinds of regulations and markets existing in the different countries. For some years now, companies in the United States in particular have found themselves operating in a highly dynamic and deregulated market where competition has obliged them to offer new services (such as Centrex, private virtual networks etc.) that do not always conform to common standards. For this reason, they see ISDN more as a support tool for the services already

available, rather than as a means of renovating and integrating the networks of the various companies operating in the United States.

In Europe, on the other hand, in accordance with EEC directives, there is a strong awareness of the need for a single basic network and the necessity to integrate the networks of the member states. This is seen as an essential prerequisite for real and effective competition in the European telecommunications market.

It was on the basis of this necessity that in 1985, Italy, France, Germany, and the UK signed an agreement called "Four-Party Group on ISDN," to define common standards that would enable their respective national networks to be interconnected by 1993. Considerable expectations were raised by this initiative to the extent that in 1989, as a result of the group's action, companies in 20 countries—including SIP, Italcable, and ASST [State Telephone Services Agency] in Italy—signed a "Memorandum of Understanding for the development of a European network by 1993."

The importance of ISDN in Europe is based fundamentally on two factors. First, it establishes a common standard for access to the telephone network that is in keeping with universally recognized international specifications. This facilitates network interconnections and access to service centers that offer value-added applications services. Second, with the digitization of subscriber lines, it allows for digital subscriber-to-subscriber connections. This makes for improved connections as well as the development of long-distance services and the integration of transport services with a common access.

For Europe it is exactly because of these characteristics that ISDN represents a natural evolution in telephone networks.

By digitizing subscribers' twin lines, ISDN can offer a variety of integrated services (audio, data, and images) efficiently and economically, through standardized access to the network by the subscriber who, depending on his requirements, may request:

- one or more basic accesses, each made up of two 64 Kbps channels (B channels), for the transmission of vocal messages, data, or images, and one 16Kbps channel (D channel) for signalling or the transmission of data packages;
- one or more primary accesses, each consisting of 30 B channels and one channel at 64 Kbps.

A survey of market prospects in Italy has been confirmed by similar surveys carried out in Europe, and shows medium to large commercial subscribers as the preferential target during the network's initial consolidation and start-up phases. As the service becomes recognized and the cost of subscriber equipment decreases as expected, a second phase will follow during the course of which, small commercial subscribers, including the tertiary and professional sectors, will be the protagonists.

Lastly, in the medium to long term, ISDN will also be of interest to the more affluent private subscribers.

A tariff schedule has been proposed on the basis of market forecasts and an analysis of implementation costs. This schedule has been presented to the relevant national bodies for approval who tend to favor access to ISDN over the multiple number of accesses currently required for the same number of services/applications. The proposed tariff structure, which is based exclusively on installation costs and a bimonthly fee with fixed rates for voice or data traffic, is in line with that of other European countries such as France, Germany etc.

Since this is a completely new service, the completion of the ISDN infrastructure is expected to take place in two distinct phases. First, a "pilot" phase, followed by the so-called commercial stage, when the ISDN service will become available on a wide scale.

The Pilot Phase

This phase (1991 - 1992) which began during the second half of the last year, is designed to field-test the feasibility of ISDN and the suitability of the marketing strategy, as well as organizational and management aspects. During this phase, the structure of the network will overlap and will include the following 11 cities: Genoa, Turin, Milan, Venice, Trento, Bologna, Pisa, Rome, Naples, Bari, and Palermo. The pilot network is equipped with 140 primary accesses and 7,000 basic accesses. A dedicated automatic telephone switching system will be installed in each of the cities and will connect ISDN subscribers in other areas through remote multiplexing and concentration units. Each automatic telephone switching system is interconnected with other ISDN exchanges in the pilot network, with the existing telecommunications infrastructures (telephonic network, sound and data network, and ITAPAC [Italian packet switching network]), and also with the ASST and Italcable ISDN exchanges). Some international ISDN link-ups—both European and intercontinental—are envisaged in the pilot phase.

During the pilot phase, other services will be offered together with the typical ISDN transport services (analog connections, digital connections, and packet assembly) and the new services currently foreseen for the digital exchanges (documentation of charges, remote meter reading, call holding signal, transfer to another number, automatic invalidation of outgoing traffic, direct dialing). These include caller identification, real-time information on charges, and multinumbers that allow an incoming call to be directed to any one of eight terminals connected to an ISDN line.

The Commercial Phase

This phase (from 1993), on the other hand, will begin in the first half of 1993. As provided for in the Memorandum of Understanding, the services offered will fully conform to international standards. During this phase, the ISDN service will be gradually extended to all

subscribers in the national network and will be interconnected with similar services in the countries that are signatories to the agreement.

SIP will make a major effort in terms of both investments and planning for a rapid takeoff of the ISDN service, and to guarantee optimum coverage over the national territory. By 1995 it will be possible to offer the service to 70-80 percent of potential subscribers. During this phase, new services will also be activated, such as the closed group of subscribers, three-party conversation, subscriber-to-subscriber signalling, the date/time of fax transmissions, and several variations on the call transfer (e.g. transfer from an occupied number, or selective transfer based on caller identity).

Market surveys have shown that subscribers view ISDN as having various advantages depending on the applications. The advantages seen in acoustic applications concern quality, with an almost total absence of sound deadening, distortion, and noise.

The advantages for long-distance services (such as facsimiles, slow scan video, and videoconferences, etc.) are that the number of services will increase, while the specific nature of the service will remain unaltered.

For applications based on subscriber-to-subscriber connections, ISDN services are viewed positively since they improve the efficiency of networks and company information systems substantially, and above all, make the development of new applications economically viable.

Problems of integration within the various computer systems do not arise, since ISDN is a circuit switching network and has connection times of less than one second. All the major computer manufacturers have developed the hardware and software products necessary to interface the components of their system—from mainframes, to personal computers, and LAN (local area networks) etc.—with the ISDN network connections which come into operation when a communication is initiated.

Forecasts are that business networks, most of which currently use dedicated circuits, will gradually be transformed and switching services for backups and traffic overflow will be used either as an addition to, or a replacement of, direct circuits. The advantages are improved elasticity, configuration, reliability, and efficiency, and overall cost effectiveness.

It is anticipated that in the short term, ISDN will tend to assert itself in the business world as a computer network. In the medium term, instead, traffic will be generated by new applications in which high-speed data and image transmission will become not only the determining element for the success of the application itself, but also a business innovation for the companies adopting it. Finally, in the long term, with the establishment of videophone services and the possibility of working from home, the use of ISDN will extend to the domestic market.

Another, but definitely not secondary, advantage of ISDN that is of interest to both users and operators, is its coordinated introduction into the main European countries. This will lead to a large common market for both telecommunications services and products.

The Development of the Intelligent Network

Diversified needs and the continuous growth of the telecommunications market, require a more timely response from management in the development and diffusion of new services. For this reason "new intelligent functions" are being increasingly incorporated into telephonic networks.

Market demand is no longer limited to the request for improved basic services. It is directed toward new applications that can promote the development of new services, and permit increased flexibility in various network functions, such as traffic routing, connection charges, the control and management of subscriber and network data, etc.

Existing telecommunications networks are characterized by a certain degree of rigidity in relation to these functions. This desired flexibility can be obtained only through new services that should be concentrated in strategic points of the country both for management and for technical and economic reasons.

The search for a solution to these problems led to the definition of the intelligent network concept. The setting up of the first systems with very few services, toll free numbers being the first, has been followed by the current definition phase of the intelligent network concept. An internationally standardized infrastructure is envisaged, with interfacing networks and service supply procedures. A point of convergence between the countries involved is being sought and an urgent standardization process is being carried out through various international bodies (CCITT [International Telegraph and Telephone Consultative Committee], ETSI [European Telecommunications Standards Institute] etc.).

The basic characteristic of such a structure is that services are no longer furnished by any single exchange, but through cooperation between the exchange and other centralized computerized systems (nodes), thus requiring the formation of a network.

The intelligent network concept, therefore, represents a completely new approach to the problem of adapting the range of services to the needs of the user. The basic advantages of this system are its improved speed and operational flexibility. Since the more complex processing is carried out within the centralized nodes (which are few and homogeneous) not only can this be done more easily (the exchange software must not be involved), but major efforts are not required each time a new release for the modification or development of new services is made.

This type of architecture also has a certain importance in the evolutionary framework of telecommunications networks. Although initially limited to the telephone service, this approach can be gradually extended to, and integrated with, other services (ISDN, personalized telephone services, etc.), and thereby greatly promoting the development of traffic and new services in the public telephone network.

The universally accepted intelligent network architecture is as shown in Figure 2 [not shown].

As far as the development of intelligent network services is concerned, they are currently a significant reality only in the United States, where they were born some 25 years ago. Despite their considerable success, the annual growth rate is still strong; around 10 percent in terms of users and 20 percent in terms of traffic.

A series of important factors in the United States have been the reason for the significant growth of these services, namely:

- the market is strongly deregulated;
- the market operates within a vast economic and territorial context that favors the development of telecommunications services;
- telemarketing services have been part of the American culture for some time now, and are widely used by operators in the promotional and advertising fields, and for the sale of various goods and services.

In Europe, however, intelligent network services are still in the initial stages of their potential development. Intelligent network services (particularly toll free numbers) are currently provided in several European countries (France, Germany, the Netherlands, and Italy) using ad hoc techniques. In the UK these services are currently available through an intelligent network architecture based on AT&T technology.

Intelligent network services in Italy, primarily toll free dialing and virtual private networks, have been commercially available since 1987.

The technology that made this early extension of intelligent network services throughout the country possible, was the voice data network. From an architectural point of view, this network is sufficiently close to the concepts that characterize intelligent networks to permit sufficiently advanced applications for the two services mentioned above. The architecture of the voice data network, and that of the intelligent network, is based on separate nodes containing the user's data and the processing resources relating to the services supplied. The voice data network, however, also exploits the common signalling channel to facilitate the exchange of information between the various network nodes.

According to market research at the national level there will be a considerable growth in such services over the next few years. SIP's development plans provide for a

nationwide intelligent network to meet the market demand for additional services.

This plan is divided into two phases. During the first phase (1992-1994), after the necessary infrastructures have been prepared, the intelligent network will be activated as part of the public service, offering those services currently available through the voice data network. From 1993 on, other services will be made available: special tariffs, universal numbering, bulk calls, and tele-voting.

During the second phase (1995), with the strengthening of the network by means of additional blocks, other important services will be activated or transferred to the intelligent network: personal numbers, and calling cards (a service introduced in 1990 through a specialized network).

The intelligent network, having developed new and more intelligent network functions, will in the future also act as a support for other services:

- vocal message services: both the recording of messages (centralized answering machines) and their eventual forwarding to the addressee. The development of audiotex services to provide subscribers with a variety of information;
- automatic collect calls;
- class services;
- Centrex, personal telephony etc.

Mobile Services

Generally speaking, mobile services in the field of telecommunications are a group of services that use various technologies based primarily on radio access, and that allow the user to send and receive messages while on the move. For this reason mobile services have always been viewed positively by subscribers, particularly among businesses and more affluent private users.

Many of these services are already well-known to the majority of users. Consider for example the success enjoyed by services such as paging, cordless telephones, cellular radiomobile services, portable telephones, etc. Other services in which mobility is not tied exclusively to radio access, Universal Personal Telecommunications (UPT) for example, are still in a development or early production stage and are less well-known to the general public.

According to forecasts, there will be a strong emphasis on the development of mobile services in the coming years. In the medium to long term, approximately 70 percent of the active population will use at least one mobile service—a market penetration that will almost equal that of the fixed network. Figure 3 [not shown] shows a relative growth rate that puts the number of fixed subscribers on a level with radiotelephone users at the worldwide scale.

Figure 3 also shows a strong increase in the personal telephone market from the mid-1990s. There are currently 7 million users of radiomobile services in the world—a minimal percentage compared with the almost 500 million subscribers to fixed networks. However, on the basis of growth rate predicted for mobile services, these figures could converge during the early part of the next century.

Figure 4 shows the situation in relation to services, applications, and the market. With the introduction of digital cellular systems, which use a spectrum of frequencies higher than those obtainable with analog systems, radiomobile services represent a turning point in the development of mobile telephony. Though initially limited to automobile travel, business subscribers in particular were immediately attracted by this service and saw positive advantages in this new means of communication.

Taking into account the possible reduction in the cost of terminal time and network equipment, many research studies indicate that the market penetration of the service will be equal to around 10 percent of Europe's active population by the year 2000. Even though there has been considerable development in this sector in the past few years, Europe still finds itself in a phase of what may be considered underdevelopment in relation to its potential, especially when compared with the United States and Japan.

The main causes of this delay have been the lack of a European standard, and small national markets where economies of scale in support of a greater market growth are not viable. This situation should change radically with the coming of two important events: the availability of the pan-European digital system, GSM (Global System for Mobile Communications) in 1992 and the creation of the single European market in 1993.

Together with cellular telephones, there will be a future increase in applications for cordless telephones. In this regard, the Telepoint service should be mentioned. Telepoint was initially conceived in the UK to allow cordless telephone users to make outgoing calls through radio base stations spread across the country.

These stations offer users a service that is similar to public call boxes. They are interconnected to the public telephone network with a centralized data base for the real-time verification of the subscriber's personal data. The service is not, however, enjoying the success envisaged by its promoters—probably because of its undirectional nature (only outgoing calls can be made).

In general, the success and a mass growth of mobile radiotelephone services are dependent not only on market forces (demand, terminal costs, tariffs, quality, etc.), but also on the number of radio channels available and the frequency bands assigned to this type of service. Radio frequencies are, however, a highly regulated and limited resource that caters to the needs of various

sectors of our society: civil and military radio communications, radio navigation etc.

If mobile radiotelephone services are to have mass growth, it is essential to increase the number of users per square kilometer handled by a given system. New solutions are being studied at the international level, and a commercial prototype of the PCN [Personal Communications Network] system will probably become available in 1993. To handle high density telephone areas, these systems are based on two important requirements: minute cells (picocells) which are indispensable in handling high density areas, and the availability of a wider band of radio frequencies.

It is envisaged that such systems, being able to handle areas with a higher user density per square kilometer and requiring a lower investment per single user than radiomobile services, will reach a penetration level of around 30 percent of the active population by the year 2000, as shown in Figure 4 [not shown] in a European market of over 50 million users.

The parallel development of telephonic networks and new services will guarantee more complex mobile services for subscribers. Here lies the concept of personal telephonics, that will mean the end of the rigid user-fixed location, or user-terminal combinations. Each subscriber will be given an identification number that he will use to identify himself to the network when making or receiving calls.

At the international level, progress is also being made in this direction with the definition of UPT. Rather than a service, UPT is a completely new concept in network management. It permits the average user to communicate with his usual correspondents, and to make or receive telephone calls (or data) by using the intelligent functions present in the network itself, even while in movement.

Such traffic can be generated by various networks (fixed, radiomobile, etc.), each with its relative charges and where transmission properties are limited only by the services of the terminal utilized.

The qualifying factors of this new way of managing UPT connections are the "profile" of the user, and the "personal number." The user's profile is a record, held in a centralized data base, describing the applications and services to which the user has subscribed (type of terminal, alternative routing, protective identification number, personalized answering services, etc.). The service is therefore managed on the basis of this profile.

The personal number, on the other hand, is a code that identifies the user alone, and is used to locate his position in the territory. The UPT does not require the user to limit himself to a fixed location (as in the case of basic telephony), or a terminal (as in the case of radiomobiles).

To guarantee a certain operational flexibility, additional services will be offered together with the basic UPT service. This will permit the user to intervene directly in some aspects of his personal profile (type of terminal, alternative routing, etc.), as and when required.

The UPT is presently undergoing a finalization phase at the principal international standardization bodies, (CCITT, ETSI). The first UPT applications (the so-called "restricted" UPT), based on few functions, are envisaged after 1995.

Finally, a mass market (estimated in terms of terminals equal to 60 percent of the active population) should be attainable by the end of the decade, with new and more advanced (see Figure 5 [not shown]) personal telephone systems, (UMTS-Universal Mobile Telecommunications Systems).

These systems, which are currently being defined within the framework of European research program, will be equipped with technological innovations that will combine all radio transmission technologies.

UMTS will be capable not only of handling information in vocal form, but also in data form. This last possibility is essential for high-speed transmissions (up to 2 Mbit/sec for applications such as videotelephony and still pictures).

Broadband Services

A great deal of attention is currently being given by all telecommunications operators to the problems of broadband networks and services. On an international level, the question of which services should be implemented, and with which technologies, has been under discussion for some years. It can be said that the long-term objective will be broadband ISDN (B-ISDN). Such a network must be capable of guaranteeing all the services classified by the CCITT. How to arrive at that point, both from a technological and a structural point of view, is still an open question.

In the present-day market, B-ISDN services as defined by the CCITT in particular, are more an evaluation of what is possible from a technological point of view, than an analysis of actual market requirements. Some evaluations of the areas of potential users have brought about a reconsideration regarding both the services to be offered on high-speed networks and their impact on network strategies. Based on these evaluations, several commercial applications have been proposed lately to satisfy the communications needs of certain users by offering tailor-made services.

It is clear that, during the introductory phase of high-speed networks at least, a significant subset of services defined by the CCITT should be considered. This subset should be tailored to meet the needs of those groups of users most qualified to readily accept the new services on offer.

These considerations are particularly critical at the present moment with the first, and as yet unclear, emerging indications of market requirements and technological solutions.

For the reasons set out above, SIP is very much involved both in contributing to the definition of international standards for B-ISDN, and also in evaluating and satisfying the emerging need for broadband services in the national market.

In Italy, the large-scale diffusion of commercial television stations capable of offering a free and overabundant service to satisfy television communication needs, the regulation of this sector, and the still-open debate, make it difficult to interpret the market for broadband services on fixed networks. On the other hand, the services mentioned are directed almost exclusively at domestic users who would, at least initially, be excluded from the offer of broadband services.

The offer of broadband services to the more sophisticated business sector is, however, another matter. With its growing communications needs and the range of applications to be satisfied, this sector is more prepared to invest in new telecommunications equipment.

The characteristics of the business subscriber, as a potential user of broadband services, are the need to transfer considerable volumes of data, to link LAN environments or other heterogeneous environments given the necessity for high-speed transmissions (for mainframes, graphic workstations, etc.), and finally, and the need to satisfy specific applications requiring the high-speed transmission of images (CAD - computer aided design etc.), or videos (videoconferences).

In Italy, an important program called START [System for Business Traffic on Telecommunications Networks] is under way to satisfy these and other needs of the business users. The system will ensure these users a telecommunications system based on a technologically-advanced network infrastructure, capable of providing both low- and high-speed telephone and data services, that can guarantee reliability, flexibility, and quality.

The basic characteristics of these systems are:

- An advanced user access system called Flexible Access System (FAS) that allows the user's existing services to be combined on a single high-quality carrier, an optical fiber, and interconnects the user with the relevant SIP exchange. To ensure improved applications and service quality, overabundance of this connection is also envisaged;
- exchange equipment to direct the user's signals to the respective networks, and depending on the type of connection required by the user, with the telephone network, ITAPAC network, ISDN, DNC [Direct Numerical Circuit], DED [Digital Electronic Distributors], etc.

Among the many broadband services that can be accessed through START are satellite and DNC direct connections currently operating at up to 2 Mbit/sec, as well as the nodes of the broadband CLAN [commutated local area network].

The CLAN network was developed by SIP within the framework of the EEC's STAR [Special Telecommunications Action for Regional Development] program for southern Italy. CLAN nodes are currently situated in Naples, Bari, Cagliari, Catania, and Milan. SIP plans to extend this network to other localities to meet users' requirements as of 1992. The services offered include high-speed connections between LAN (Ethernet and Token Ring), and Host. From the beginning of 1992, the network will also offer frame relay services which represent an innovative solution in LAN interconnection services.

Subsequently, the CLAN network—evolving toward SMDS on the IEEE 802.6 standard currently being defined—will be integrated with other applications already being implemented and that employ MAN [metropolitan area network] technology.

The concept of metropolitan networks arose initially from the need to extend the potential of LAN to a wider area than that covered by a local network. This need, which was and still is, the main objective of MAN, can now be fulfilled and in the future a wider range of services offering an integrated response to communications requirements will be available to the business community.

MAN applications already in function or envisaged shortly, concern the city of Turin (already in function) and in collaboration with CNR [National Research Council] the cities of Trieste and Florence/Pisa.

Conclusions

In industrialized countries, telecommunications are becoming an increasingly strategic resource, that is indispensable not only for social development, but also to increase the competitive capacity of individual countries. Consequently, the evolution of the technical infrastructure of telecommunications networks toward more efficiency and a greater response to user requirements in terms of flexibility and personalization of services can no longer be postponed.

From what has already been said, it can be seen that things in Italy are moving quickly to ensure that the growth of national telecommunications networks, in terms of market penetration and the development of services, is in line with that of other European countries. This development process, particularly of the networks, is backed by an investment plan that is one of the largest in Europe—approximately 43 trillion lire over 1991-94.

The principal elements of this investment will be the penetration of the basic telephone service which, during the next few years, should come into line with that of the

more advanced European countries; the complete digitalization of the basic telephone network; and the development of services—the most important among which are ISDN, the intelligent network, mobile services, and, of course, broadband services for the business community.

The intent of this article is to give a picture of the envisaged development plan. However, the telecommunications services currently offered by SIP already include network services capable of handling the most advanced applications (the ITAPAC network, for example, for the transmission of data packages, and the LAN networks). These applications will undergo a considerable development process that will permit the services offered to keep pace with market requirements. Naturally, this process will take place in stages, in line with the other new developments described in this article, and within the context of a coordinated and well-balanced growth in the entire field of services offered by the public administration.

Norwegian Telecommunications Industry Surveyed

92WS0394A Duesseldorf *HANDELSBLATT* in German 10 Mar 92 p B15

[Article by Kjell H. Husby, president of the Norwegian Information Technology Association: "Information Technology—Rapid Technical Progress and High Development Cost Require Flexibility—The Successful Strategy: High-Tech Products and Customized Solutions For International Clients"]

[Text] Norway, a small country at the edge of Europe. What can we expect from the communications industry of such a country? Average products for conventional purposes? Can such a small country successfully compete with large multi-national companies and, if so, how?

The fact is that exports by Norway's telecommunications industry are growing steadily. If we consider the Norwegian information technology (IT) industry as a whole, Norway has a total of approximately 180 companies, 130 of which are manufacturing companies, and the remaining 50 are consulting and service firms.

Exports Account for Up to 90 Percent

The Norwegian Council for Science and Industrial Research (NTNF) estimates total sales of the 130 manufacturing companies at approximately 16 billion Norwegian kroner [nkr]. Exports account for 30 percent of this sum or 5.4 billion nkr.

Although the majority of the products are targeted for the domestic market, some companies export 70 to 90 percent of their total sales.

If we divide the information technology sector, we get the following export figures for the individual groups:

- Computer and computer-related systems—2.0 billion nkr

- Telecommunications equipment—1.4 billion nkr
- Maritime and other "special" electronics—1.6 billion nkr
- Other—0.4 billion nkr

In view of the limited capacity the question arises how Norway managed to develop such a highly advanced communications industry.

In retrospect one might be tempted to give the following explanation which is probably presumptuous: We in Norway predicted the development of this industry many years ago, developed a long-term strategy and adhered strictly to this strategy. However, the answer is much simpler.

The fact is that our highly advanced industry has developed due to a number of factors such as our natural history, our school system, the geography and topography of our country, climate, etc.

Functionality and Quality

The country itself is long and narrow. Deep fjords characterize and shape the coastline towards the Atlantic Ocean. Our industry is decentralized, and the 4.2 million inhabitants are spread across the country. It is quite obvious that communications are very important for us.

Our shipping industry, the fourth largest in the world, was of crucial importance for the country's development primarily because of the large distances, the sea and the widely scattered population.

As a people we are proud, individualistic and well-educated. We encourage and admire creativity. Functionality and quality are a must. Design was a byproduct of functionality. Special solutions became our standard.

Here is an example: In 1976, Norway was the first European country to use satellite communications for its national telephone network; originally, it was intended for communication with the drilling islands in the North Sea.

Gradually, the satellite communications systems were used to support our worldwide merchant fleet with high-quality, reliable and cost-effective telecommunications services. Today, this service is available to companies all over the country.

As a further development, the Norwegian Telecom supports a new public air-ground-communications network called Skyphone which is maintained jointly by Norway, England and Singapore.

So far, Norwegian experts have supplied all groundstations for this new air-ground-service worldwide.

Another example: Utilization of Norway's huge hydroelectric power under severe climatic conditions for the past century has created the basis for highly developed

power network communications and an expert monitoring system. Today, these quality systems and their know-how supply world markets.

What characterizes our products and services? Quality, small production series, creative customer solutions where functionality has priority over design and reputation.

Mass production for the large markets has never been a goal of the Norwegian telecommunications industry. Rather, the industry development was based on special requirements and demands of the domestic market. As a result, the development of a number of quality products is targeted at a few selected areas.

Recently, however, the product life has become increasingly shorter. Since there is a demand for more and more product improvements, development costs continue to rise. The volume which was previously obtained by a long product life in a geographically limited market, has to be achieved in a different way.

Basically, there are two methods which provide an answer to this development:

- Diversification, i.e. production of related products for the same market to supply more products and larger quantities which would justify the development costs;
- or Introducing a few, but sophisticated products and solutions to the world market to sell more units.

For the Norwegian telecommunications industry, the following alternative is certainly the right choice: Worldwide specialization is the answer and will most likely continue to be our strategy in the coming years.

Here, a few market trends which support this strategy:

- Rapid and improved worldwide telecommunications reduce distances and help strengthen ties across borders;
- More open trade agreements with fewer restrictions increase international trade;
- Government measures to simplify regulations and to do away with monopolies increase competition and offer customers less expensive and better solutions.

Broad Product Range for World Market Niches

- More comprehensive and better international standardization increases competition, reduces cost and increases flexibility—all to the customer's benefit;
- Maritime electronics: In this field, the product program includes high-quality acoustical underwater equipment, location of schools of fish, positioning and defense applications as well as automatic communication and navigational devices. In addition, radio stations, radio beacons for emergencies, transmittal equipment and antenna systems;
- Long-distance communications. To overcome the enormous difficulties presented by the mountains, long distances and scattered population the industry was able to develop a leading position in this field.

Examples are satellite communication with the worldwide merchant fleet, the oil fields in the North Sea and the above mentioned Skyphone project.

In addition, there is equipment such as antenna systems, telemetry equipment and solutions for industrial and military applications, communication with electrical power plants as well as management systems.

- Internal communications systems. The Norwegian way of doing business—more democratic and less hierarchical—combined with the requirement of maximizing the efficiency of organizations is probably the main reason for the fact that Norwegian companies count among the leading worldwide suppliers of speech-oriented, internal communications systems of all types;
- Data Communications—Norwegian companies use state-of-the-art technology to supply the world market with network systems, data communications terminals and data storage systems.

Research and Development

The Norwegian communications industry reinvests 10 percent of its operating income in research and development (R&D). A lot of the industry's R&D is done in close cooperation with a number of specialized research institutes and laboratories.

The Foundation For Scientific and Industrial Research at the Norwegian Institute of Technology (SINTEF) cooperating with the Norwegian Institute of Technology, for instance, played a central role in the development of the Nordic mobile telephone system NMT 450 and NMT 900. In addition, through its research center Norwegian Telecom Research (TF) Norwegian Telecom contributed greatly to the groundwork leading to the development of GSM, the ETSI rules for a global mobile communication system.

As a result of these efforts, the introduction of two cellular telephone networks in Norway based on the European GSM standard is planned for 1993.

The Norwegian Institute for Defense Research (FFI) played an important part in the development of quality communications accessories for the military with services for civilian purposes as byproducts.

The Norwegian Council for Scientific Research (NTNF) participates in the development of a strategy for this industry by supporting strategically important research projects.

And finally, the Society of the Norwegian Information Technology Industry (ITF) acts as an active partner for all companies.

France Telecom, Deutsche Telekom To Form Joint Venture

92WS0424D Paris AFP SCIENCES in French
12 Mar 92 p 15

[Article entitled: "A Sweeping Collaboration Agreement Between France Telecom and Deutsche Telekom"]

[Text] Paris—France Telecom and Deutsche Bundespost Telekom have just signed a sweeping framework-agreement to create a joint venture to serve international businesses. The two carriers announced the agreement in a joint communique that was published 11 March in Paris.

France Telecom and Deutsche Telekom will hold equal shares in the joint venture, which should be formed

under the name Eunetcom within three months. The communique indicates that the new company will maintain and operate the international telecommunications networks of the businesses and "coordinate European and/or worldwide data-transmission networks."

These details should spark fresh speculation on the current state of negotiations with British Telecom regarding the French and German carriers' possible investment in Syncordia, a subsidiary of BT.

If the proposed investment did go through, the carriers could acquire shares in Syncordia through Eunetcom. Indeed, the communique states that "Eunetcom will in the future be able to invest in organizations with similar business aims."

TELECOMMUNICATIONS

Hungary: Draft Telecommunications Law Criticized

92WS0452A Budapest *COMPUTERWORLD/*
SZAMITASTECHNIKA in Hungarian 10 Mar 92 p 3

[Article by Jozsef Mess: "The Telecommunications Law; It Is Time To Connect"]

[Text] Representatives of telecommunications companies and members of the National Informatics Interest Federation of Self Governments (in brief, the Informatics Federation) sat down at a conference table on 26 February. They harmonized their positions in connection with the draft telecommunications law and the national telecommunications policy concept offered as a supplement. In addition to the invited self government representatives, the meeting, the host for which was the Muszertechnika [Instrument Technology] Company, was attended by Kalman Katona, the National Assembly representative charged with working on the subject.

Not long ago in Dunaujvaros a few telecommunications companies worked out a common stand which was described as follows by Peter Pecz, business director of the Dunatel Company: "In our opinion the draft law does not satisfy the basic criteria. Before all else a telecommunications law should admit that it is a branch law of the concessions law; that is, it must be made clear to the enterprises under which laws this area falls. Otherwise the enterprises will not be able to compete for concessions in an area.

"It is also questionable how concession fees and prices will be determined. Nor does it clarify the future of monies paid in from here. For example, they certainly cannot be used to manage budget deficits; instead of that they should be returned to the investors. We feel that this could be solved by a property proportional distribution. Thus those investing in this area would share in receipts, and thus in the profits, according to their capital ratio.

"One can also debate with the arguments based on economies of scale. This draft law is directed at maintaining a monopoly or quasi-monopoly situation, in defense of the Hungarian Telecommunications Enterprise. In the case of a free market, they say, there would be no one willing to work in areas which had no business advantages. Well, we can say that our model, the backbone of which is competition oriented, self-regulating operation, can make every area of the country profitable.

"We recommend that a holding company, which will take care of developmental aspects, should bring together the enterprises providing service. We feel that all this can be realized through harmonization with the self governments."

Tamas Kolossa, president of the Informatics Federation, said that the opinion of the federation was essentially the same as that of the companies, but he called attention to

one essential difference. They feel that it is necessary to create a Telecommunications Council, so that more of those affected could participate in working out a national telecommunications concept. This is all the more needed because the present draft law does not reflect any definite telecommunications policy idea and without this, he asked, how can one legislate.

After this, Representative Kalman Katona took the floor, granting in advance that the draft law really needed to be reworked. The government, he said, had asked the committee dealing with this to discuss the draft again and prepare a package of initiatives to modify it. He asked those present for help in this, noting also that the way one should participate in legislation was with concrete, constructive recommendations connected with given points of the law, instead of making broad statements. In his opinion the framework law and the formulation of policy should be separated, because the former is a long-range feature while working out a telecommunications policy concept and harmonizing it with the law will be the task of the appropriate minister.

The draft was also criticized because of its superficiality. Mihaly Dohan, for example, an expert for the Informatics Federation, cited the American and British telecommunications laws as examples; in their extent they are nearly 10 times longer than the material submitted as the Hungarian draft law. Mr. Dohan said that the Federation had prepared a model proposal even earlier.

Finally, those present agreed that they would issue two statements, one addressed to the self governments and another intended for the committee preparing the law. In these they would urge the creation of a Telecommunications Interest Harmonizing Forum which would have the task of developing a real telecommunications concept.

Current Problems With Czechoslovak Telecommunications Network Aired

92WS0478A Prague *TELEKOMUNIKACE* in Czech
Mar 92 p 44

[Article by Eng Jiri Makovec, Administration of Posts and Telecommunications in Prague: "A Commentary on Current Problems of Telecommunications in the Czech Republic"]

[Text] Telecommunications are an exceedingly important part of the infrastructure. They are characterized by their network system, requirement of extensive investments, and enormous amounts of work involved in their construction, particularly of subscriber networks. Due to long years of planned neglect of capital investments and to the draining of created resources into the state budget, the situation of the telecommunication network in the Czech Republic and the standard of services offered are unsatisfactory in terms of quantity, accessibility and quality.

Telecommunication services—and among them, particularly telephone—may be regarded as services of exceptional importance to all citizens in any country. If we proceed from the principle that telephone services should be accessible to all at the same cost, we find that offers of this service cannot be controlled by market forces alone, because very different profitability is achieved in different locations and a financial balance between individual areas in our country is a must. Consequently, in that case, the market is regulated and the operator is subject to control so that he expends funds efficiently and so that the charges for the service are commensurate, but on the other hand, the operator must be assured of adequate profitability to enable him to cover renewal and development.

Introduction of competition in the special area of telecommunications poses a complex problem; with the exception of the U.S. and Great Britain, it still remains in the realm of considerations, negotiations and discussions. Uncontrolled introduction of competition unrestricted by specific conditions would result in a system of pulling out plums from the pie, and thus, to unfair competition with disastrous economic impacts on providers of across-the-board services. Consequently, it may also violate the principle of equal access and equal charge. The solution to the whole gamut of problems is the so-called regulation framework based on analyses of network conditions, market, saturation of services, and economic conditions; with regards to the experience of the development in advanced states, it stipulates rules of conduct for subjects providing telecommunication services. In brief, in the branch of telecommunications free competition cannot be introduced due to objective reasons in the basic network, and the effect of market mechanisms must be replaced by regulations. Work on such a regulation framework as well as a study of tariff policies and a proposal for the structure of the sector of telecommunications—since these problems are closely related—have been initiated earlier this year within the PHARE [Poland-Hungary: Assistance to Restructure the Economy] program with participation of European experts and under the leadership of the British PA Consulting Group. The study which is financed by grants from the European Community will cost several million ECU.

With the exception of radio and television broadcast in the Czech Republic, the operator of all classic telecommunication services is the Administration of Post and Telecommunications, state enterprise in Prague (hereafter SPT Prague, s. e.). In cooperation and with personal participation of experts from the European Bank for Reconstruction and Development (EBRD), World Bank (WB-IBRD), and the European Investment Bank (EIB), the so-called first telecommunication project was prepared for the SPT Prague, s. e. It deals comprehensively with the development of telecommunications in the Czech Republic to the year 2000. The project conforms with the decision on the development of telecommunications, issued by the governments of the Czech

Republic and of the CSFR; its aim is to reach the European standard and balance offer and demand by the year 2000. The project is balanced, which means that its result will be radical improvement of the telecommunication network and services and at the same time, the project is feasible in terms of time, funds and material. An especially interesting characteristic of this project is that it is self-financing, in other words, the basic plan does not have to count on direct inputs of foreign capital. The project is funded from retained earnings and suppliers' and bank credits. After the telecommunication sector of the SPT Prague, s. e., is privately owned, inputs of foreign capital may be considered for acceleration and expansion of the basic program. Privatization is planned under the supervision of the MHPR [Ministry for Economy Policy and Development] of the Czech Republic in accordance with the approved document "Study of the Strategy of De-etatization and Privatization of Communications in the Czech Republic." It counts on numerous forms of transfer of technical, commercial and managerial know-how from foreign operators of telecommunications.

The telecommunication project may be characterized by the following aspects:

- At present, there are 1.6 million main subscribers' telephone stations; their density is 16 stations per 100 citizens;
- In the year 2000, main stations will number 3.5 million; their density will be 33.4/100 citizens;
- The number of public telephones will increase from 14,000 to 25,000;
- In 1992, about 200,000 of subscribers' stations will be put in operation in capacitance of central exchanges (Prague 100, Brno and South Moravia 100);
- By 1995, at least 510,000 telephone stations will be established (in the Czech Republic the waiting list contains at present 380,000 applications);
- By the end of 1993, the construction of an overlapping transit digital network will be finished, which will decongest the existing network and increase its capacity (better connections);
- By the year 2000, investments will amount to US\$3.5 million;
- Charges for services will not increase drastically; in essence, they should remain in step with the inflationary trend.

Regardless of all the above-mentioned correlations, it seems certain that no later than May 1992 the minister of communications of the CSFR will issue a license to another operator, with an untoward impact on the efficiency of the first telecommunication project. How will it affect the willingness of the WB, EBRD and EIB to provide their already pledged loans? What will the EC think if the structure of the telecommunications sector is essentially predetermined without regard to the already initiated preparations of the regulation framework financed by the PHARE program? At the same time, the introduction of a competing operator is being discussed by the EC; only in Great Britain is there a second

operator, but there the economic situation is completely different and the level of development of its telecommunications infrastructure is diametrically different. Another dangerous effort of the FMS [Federal Ministry of Communications] is the splitting of the SPT Prague, s.e., into smaller regional enterprises and the separation of the long-distance network. Such a solution in the situation of the CSFR is self-serving; it is not used in Europe, and its economic consequences will prove destructive for the whole telecommunications sector. Such steps can hardly encourage confidence, for instance, in the safety of foreign investments.

According to the adopted amendment to law on telecommunications No. 110/64 of the Collection of Laws, the FMS will conduct all administrative operations until an administrative agency of the republic is established. The training program for administrative agencies for telecommunications in the Czech Republic has not been prepared; there is no coordination; the state administration will be hamstrung in its operations until a structure of the agencies of the Czech Republic is developed. No foundations have been laid for a regulatory agency that could be controlled by the public; everything is left in the hands of an omnipotent state official. No control mechanisms nor procedures for decision-making on fundamental issues with vital, long-range and often irreversible impacts have not been stipulated.

The amendment to the law on telecommunications and the preparation for the issuance of a license to a second operator of telecommunication services for the whole area of the CSFR cap a remarkable period of non-conceptual work on the part of the FMS. In addition to

non-existent written developmental concepts (actually, the only written document is the 1990 "Strategy for Accelerated Development of Communications," whose roots go back to a more distant past) a great number of studies which are essential for the development of the network and digitalization have been neglected; thus, obligations specified by the constitutional law on the federation have not been fulfilled; no methodology for regional planning has been prepared; all technical requirements have not been met; no zip code and numbering plan has been developed, and this list could go on and on. Despite all the facts mentioned above and although all conceptual materials and especially the first telecommunications project are at the FMS's disposal, Minister Ehrenberger wrongly accused me in public, among other things, that I lack "adequate programs for development and investment programs." The whole situation is the culmination of abnormal conditions when during his whole tenure the minister of communications of the CSFR has refused to meet with the management of the SPT Prague, s.e., failed to take part in a single important program during the planning of digitalization, and has not once paid an official visit to the SPT Prague, s.e.

The threat to the development of telecommunications will hurt not only telecommunications per se and the revenue sector of the budget of the Czech Republic (according to the project, in the 1992-2000 period Czech telecommunications will pay a total of Kcs 62 billion in taxes at the current rate of taxation) but naturally, also the entire economic development in the Czech Republic and the ongoing economic reform—not to mention our reputation abroad.

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